Operator Manual

SCANIMATE SYSTEM

COMPUTER
IMAGE
CORPORATION

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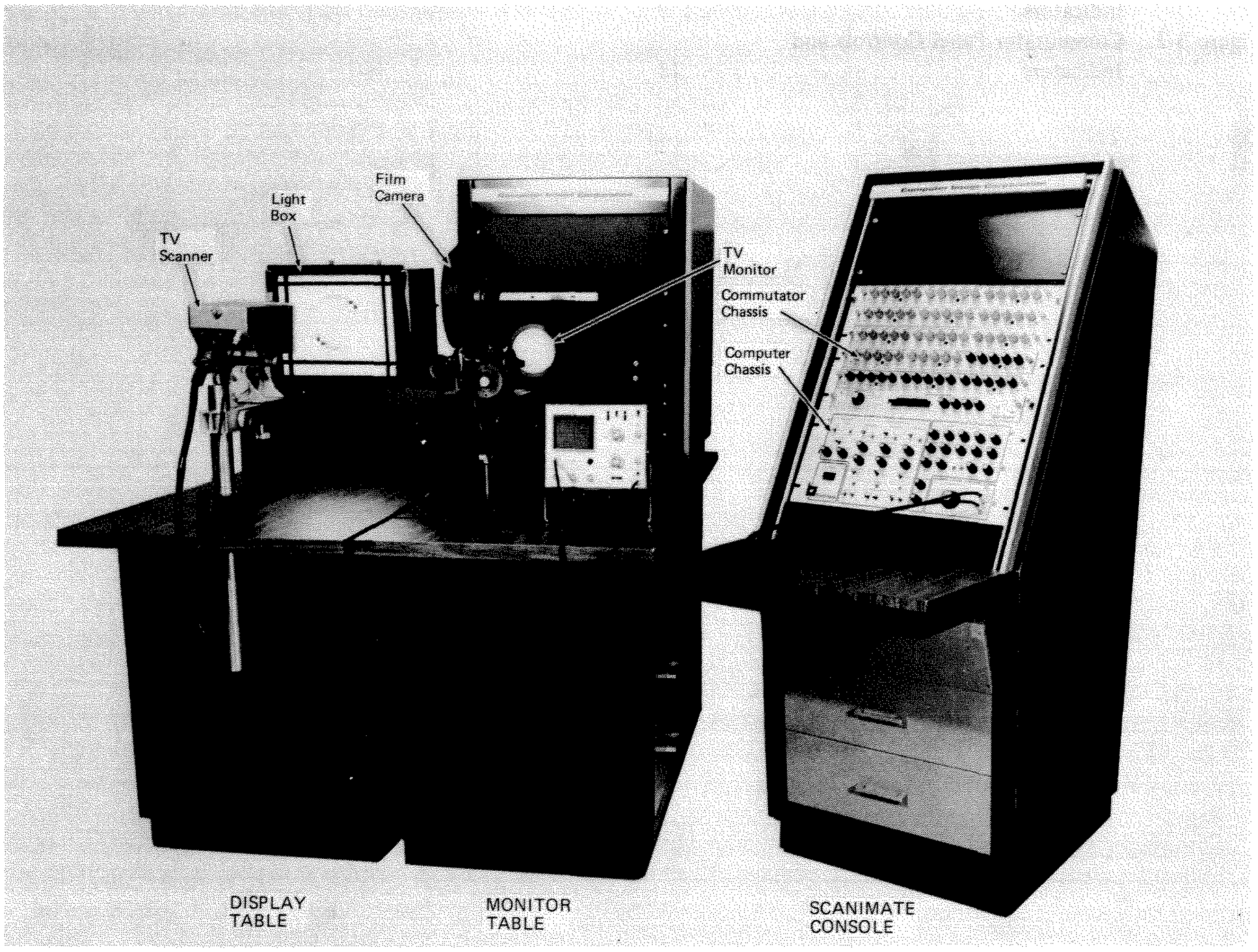


Figure 1–1. SCANIMATE System

CHAPTER I

GENERAL INFORMATION

1-1. PURPOSE OF MANUAL.

1-2. This manual describes the installation, operation, and general maintenance of the SCANIMATE System produced by Computer Image Corporation, Denver, Colorado.

1-3. PURPOSE OF SYSTEM.

1-4. The SCANIMATE system electronically animates TV presentations. Static presentations, such as a piece of artwork, or dynamic scenes may be animated under control of the SCANIMATE operator. The operator sets up the SCANIMATE TV scanner to scan the scene or artwork which is to be animated. He then adjusts the system to perform the desired animation sequence. The SCANIMATE automatically performs the animation on a XY monitor. The animation sequence displayed on the monitor is filmed by a movie camera and is the SCANIMATE system output.

1-5. DESCRIPTION OF SCANIMATE SYSTEM.

1-6. The SCANIMATE System is composed of three units, the SCANIMATE Console, the Monitor Table, and the Display Table (see figure 1-1).

1-7. SCANIMATE CONSOLE.

1-8. The SCANIMATE Console mounts the SCANIMATE computer chassis and the Commutator chassis above the console work surface (see figure 1-1). Below the work surface within the cabinet are storage drawers.

1-9. MONITOR TABLE.

1-10. The Monitor Table mounts the SCANIMATE TV Monitor and the film camera used to record the animations presented on the monitor. The monitor and camera are mounted on the table (see figure 1-1) and the monitor electronics and power supplies for the Monitor and Display Table are located inside the table.

1-11. DISPLAY TABLE.

1-12. The display table mounts the TV scanner and a light box used to backlight the artwork being scanned (see figure 1-1). When monochrome video is to be generated, a single light source is employed in the light box. When color animations are to be filmed, a three-color light box called a cricket box is used. Mounted below in the cabinet are the camera control electronics and storage drawers.

1-13. LEADING PARTICULARS.

1-14. Leading particulars of the SCANIMATE System are listed in Table 1-1.

Table 1–1. Leading Particulars

Characteristic	*Description*
AC Power Requirements	115 VAC, 50-60 HZ, single phase, 20 amps, 3-prong grounded.
DC Power Requirements	Internal Supplies satisfy all system DC requirements.

CHAPTER II

INSTALLATION

2-1. GENERAL.

2-2. The SCANIMATE System is designed to operate within a temperature and lighting environment suitable for general office or electronics laboratory use. No special heating, cooling, or lighting is required. Unpackaging and Installation instructions are given below.

2-3. SYSTEM INTERCONNECTION.

2-4. The major power distribution center for the SCANIMATE is the Monitor Table. The Monitor Table main power connector is plugged into a power receptacle supplying 115 volts, 60 Hz, single phase power. Power connections and signal connections are made from the Display Table and SCANIMATE Console to the Monitor Table as shown in figure 2-1.

2-5. UNPACKAGING INSTRUCTIONS.

2-6. The SCANIMATE System is shipped from the factory using best commercial shipping practices. The three consoles are crated separately and the cables are stored in the drawers in the bottom of the SCANIMATE console. The chassis in all consoles are secured and then taped shut. The CRT in the Monitor Table is usually removed and shipped separately. Use care when handling the CRT during replacement.

2-7. Upon receipt of the SCANIMATE System, position the three consoles as shown in figure 1-1.

2-8. Remove all tape and packaging material from the three consoles.

2-9. INSTALLATION INSTRUCTIONS.

2-10. Installation consists of connecting all interconnecting cabling, installing CRT (if removed), and applying power to the system.

2-11. All interconnecting cables are stored in the SCANIMATE Console drawers. Remove the cables and connect the three consoles as shown in figure 2-1. Note that the coaxial cables are all interchangeable. All other cables are labeled at both ends as are the receptacles to which they connect. Figures 2-2, 2-3, and 2-4 illustrate the connections.

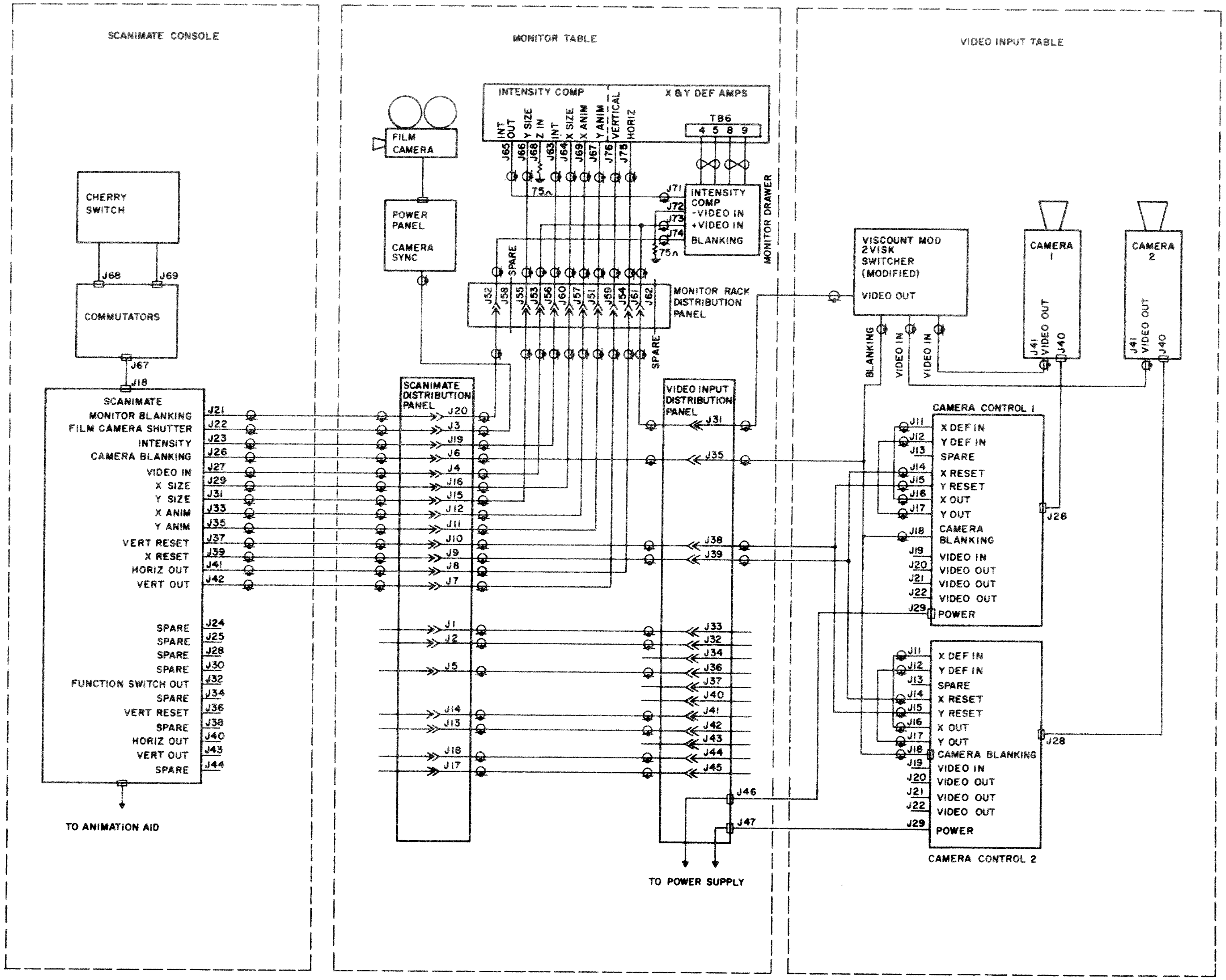


Figure 2-1. SCANIMATE System Interconnection Diagram

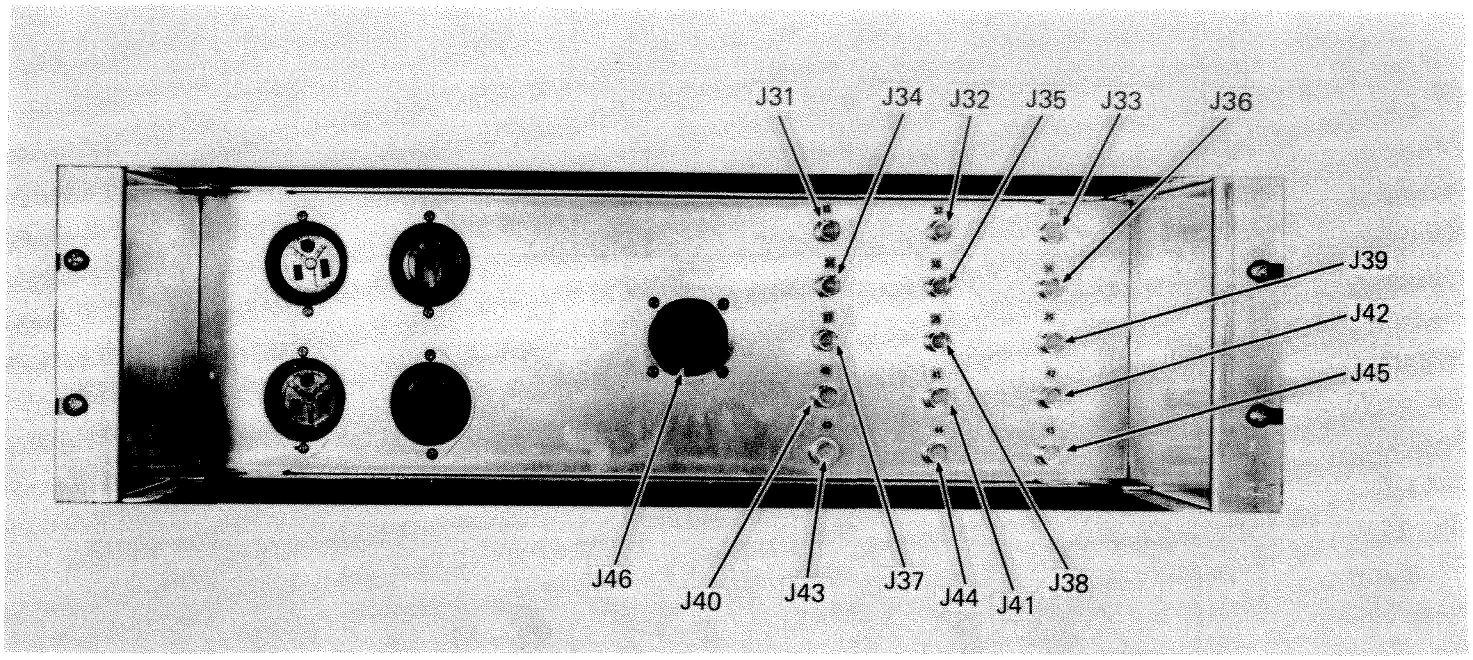


Figure 2–2. Monitor Connection Panel

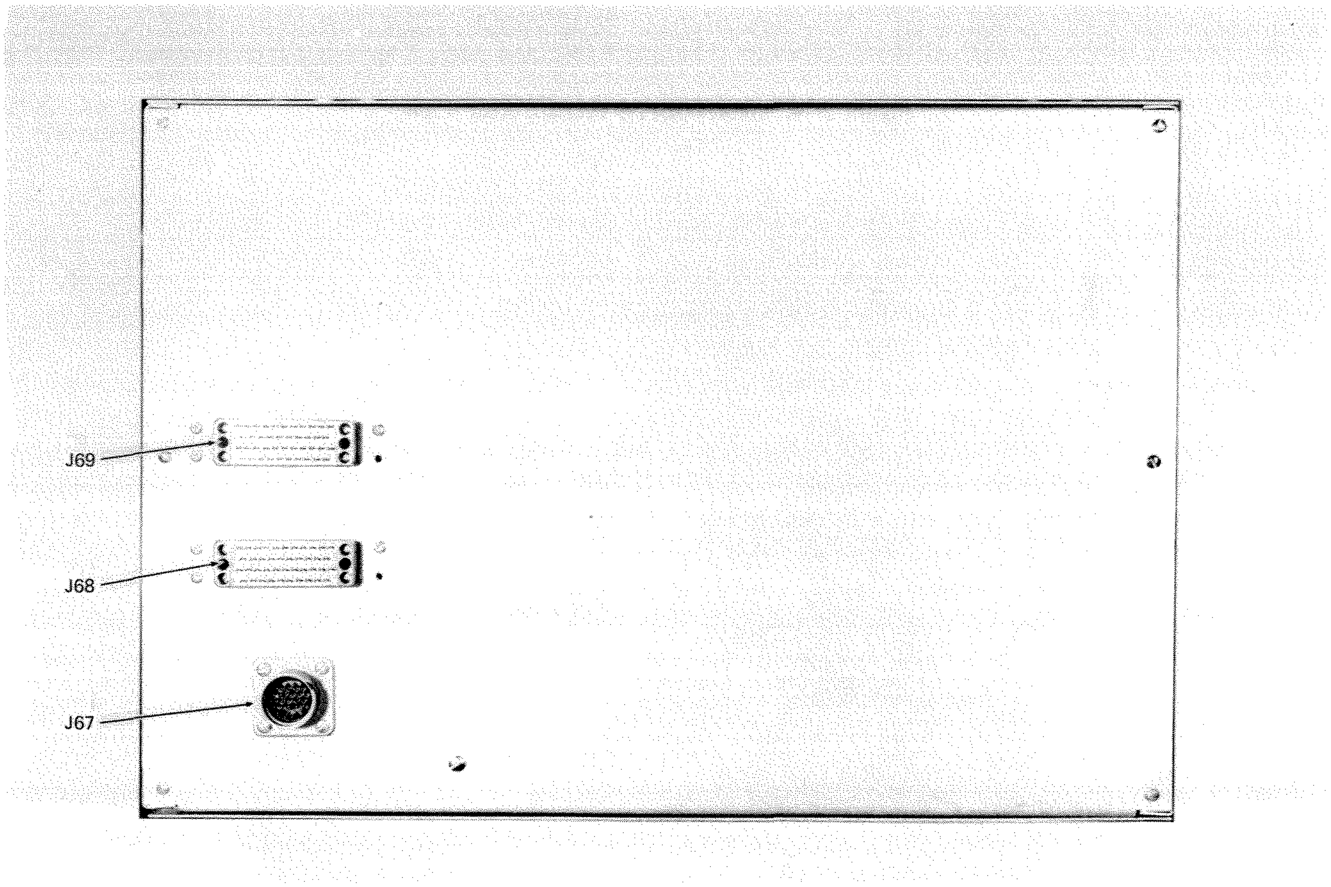


Figure 2–3. Commutator Chassis, Rear View

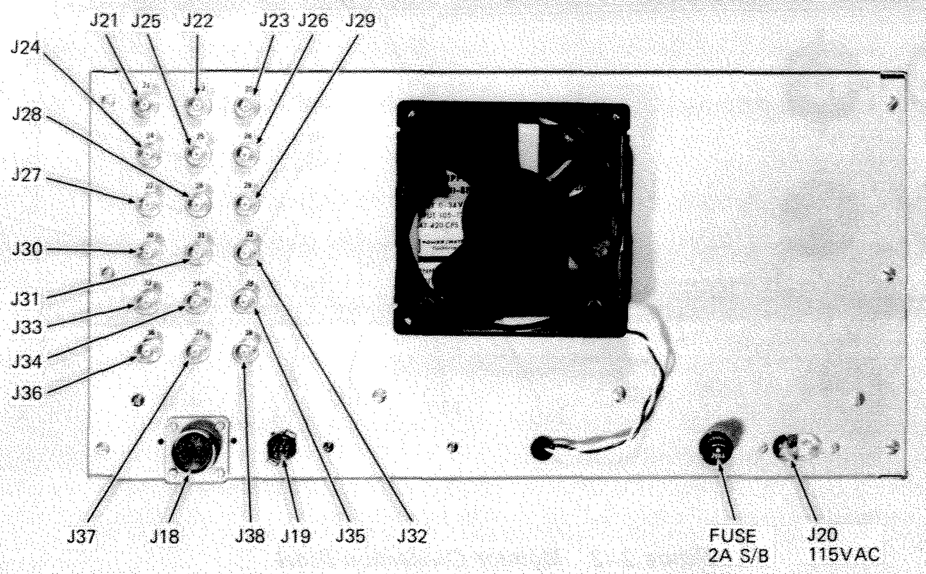


Figure 2–4. SCANIMATE Chassis, Rear View

CHAPTER III

OPERATION

3-1. GENERAL.

3-2. This chapter describes the operation of the SCANIMATE system. It contains the system operating controls and indicators, system turn-on, set-up, shut-down procedures, and general operating procedures.

SECTION I

OPERATING CONTROLS AND INDICATORS

3-3. LOCATION AND IDENTIFICATION.

3-4. The SCANIMATE system operating controls and indicators are located on the SCANIMATE Console, SCANIMATE and Commutator chassis. Table 3-1 lists SCANIMATE chassis operating controls and indicators. Table 3-2 lists Commutator Panel operating controls and indicators.

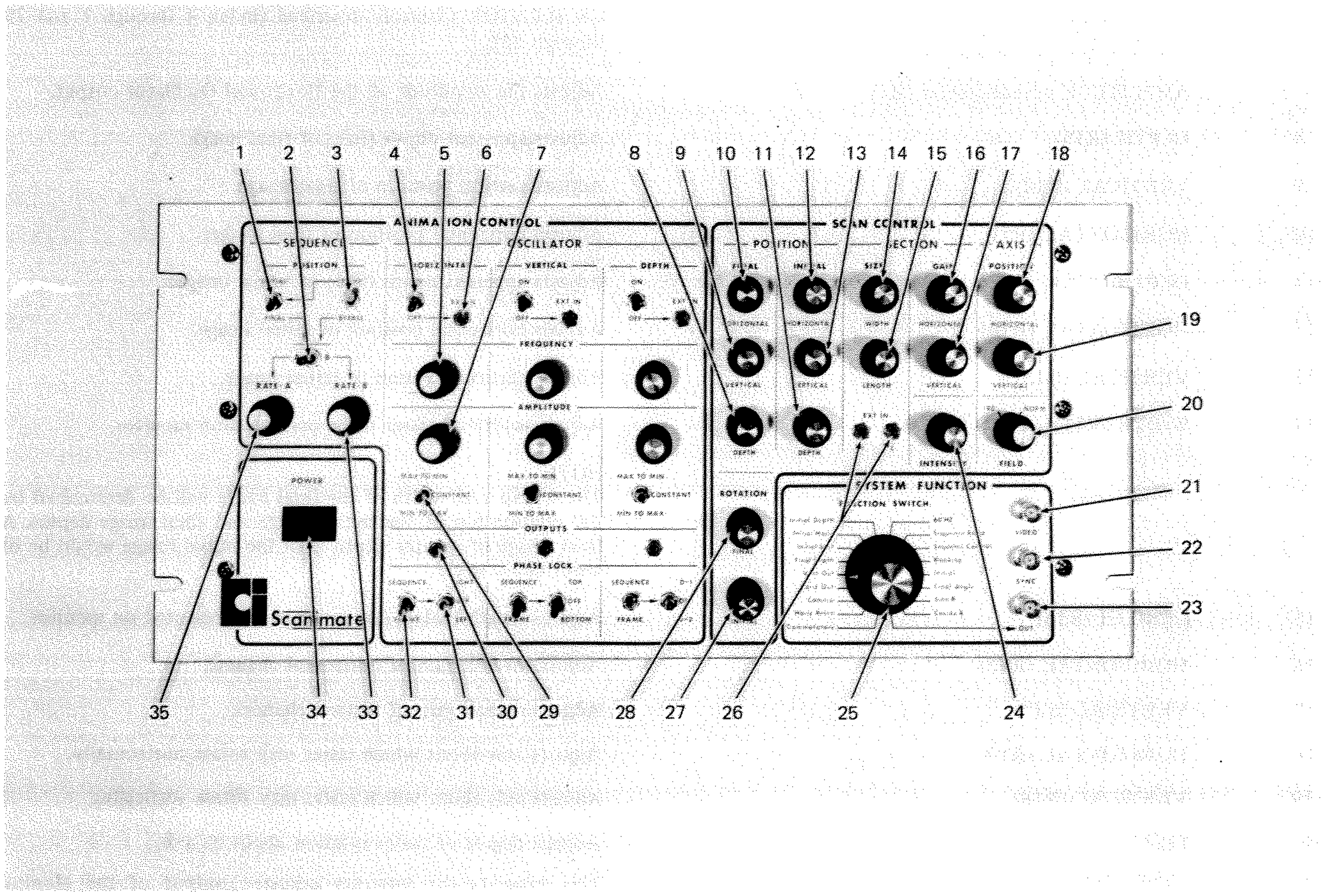


Figure 3-1. Computer Chassis Controls & Indicators

Table 3–1. SCANIMATE Chassis Operating Controls and Indicators

Index	*Name & Reference Designation*	*Function*
1	INITIAL-FINAL Switch (S2)	This switch is normally in the INITIAL position. When thrown to the FINAL position it initiates the SCANIMATE animation sequence.
2	Rate Select Switch (S3)	This switch specifies which of the two possible inputs is to set the animation ramp rate.
3	RAMP-BYPASS Switch (S4)	This switch is normally in the RAMP position. In that position a standard animation ramp is produced when the INITIAL-FINAL switch is thrown to its FINAL position. The selected rate potentiometer, instead of the ramp generator, is connected to the depth circuit when switch is in the BYPASS position.
4	ON-OFF switch (S5)	The ON-OFF switch when in the ON position applies the Horizontal Oscillator to the Horizontal Channel. When in the OFF position the Oscillator is disconnected.
5	HORIZONTAL FREQUENCY potentiometer (R3)	This pot adjusts the output frequency of the Horizontal Oscillator.
6	EXT IN jack (J45)	This jack allows an external signal to be introduced into the horizontal channel for animation purposes when the ON-OFF switch is in the OFF position.
	VERTICAL OSCILLATOR controls	These controls function similarly to the HORIZONTAL OSCILLATOR Controls described (index 4 through 7 and 29 through 32).
	DEPTH OSCILLATOR controls	These controls function similarly to the HORIZONTAL OSCILLATOR Controls described (index 4 through 7 and 29 through 32).
7	AMPLITUDE potentiometer (R4)	Adjusts the amplitude of the Horizontal Oscillator output.
8	DEPTH (R19)	Adjusts apparent depth (size) of final image.
9	VERTICAL (R14)	Adjusts vertical position of final image.
10	HORIZONTAL (R9)	Adjusts horizontal position of final image.
11	DEPTH (R20)	Adjusts apparent depth (size) of initial image.
12	HORIZONTAL (R10)	Adjusts horizontal position of initial image.
13	VERTICAL (R15)	Adjusts vertical position of initial image.
14	WIDTH (R11)	Adjusts width of raster to be presented on monitor.
		NOTE The length and width of the final image will be determined by the relationship of the initial image and final image depths. A final image at greater depth than the initial image would be of lesser raster size.
15	LENGTH (R16)	Adjusts length (height) of raster to be presented on monitor.
16	HORIZONTAL (R12)	Adjusts overall gain of horizontal channel.
17	VERTICAL (R17)	Adjusts overall gain of vertical channel.
18	HORIZONTAL (R13)	Adjusts axis about which raster may rotate horizontally.
19	VERTICAL (R18)	Adjusts axis about which raster may rotate vertically.
20	FIELD	Adjusts degree of raster rotation about its axis.
21	VIDEO jack	This presents the intensity adjusted output of the Monitor Video Amplifier for oscilloscope viewing. (Currently the video from the scanner is not coupled to the computer.)

Table 3–1. Continued

Index	*Name & Reference Designation*	*Function*
22	SYNC jack	Provides vertical reset sync pulse outputs for use on oscilloscope.
23	OUT jack	Provides monitor point for each position of the FUNCTION switch.
24	INTENSITY pot (R21)	Adjusts monitor CRT trace intensity.
25	FUNCTION Switch (S1)	This switch applies the indicated SCANIMATE signal to the OUT jack (index 23).
26	EXT IN jacks W (J51)	W provides for an external sign of +10V to −10V to be used as a raster width control input added to the WIDTH control
	L (J52)	L provides a similar input for length of the raster.
27	INITIAL	Adjusts initial image rotation position.
28	FINAL	Adjusts final image rotation position.
29	Ramp Select Switch (S8)	The Ramp Select Switch determines the amplitude of the Horizontal Oscillator signal which is to be applied to the Horizontal Channel. In the MAX TO MIN position animation due to the Oscillator goes from a maximum to a minimum value. In the MIN TO MAX position the reverse situation is obtained. In the CONSTANT position, the animation effect is unvarying.
30	OUTPUT jacks (J48)	Provides monitor points for horizontal, oscillator outputs.
31	Sync switch (S12)	This switch selects the direction from which the oscillation is to begin (The switch is used primarily when the FRAME-SEQUENCE switch is positioned to SEQUENCE).
32	SEQUENCE-FRAME switch (S11)	In the FRAME position this switch synchronizes the horizontal oscillator to the monitor frame rate. In the SEQUENCE position the oscillator is synchronized to the start of the animation sequence.
33	RATE - B potentiometer (R2)	Adjusts the rate of animation ramp when the Rate Select switch is set to B.
34	POWER switch	Turns power on to the SCANIMATE system.
35	RATE - A potentiometer (R1)	Adjusts the rate of the animation ramp when the Rate Select switch is set to A.

TABLE 3–2. Commutator Chassis Operating Controls and Indicators

Index	*Name & Reference Designation*	*Function*
		NOTE Each of the five numbered potentiometers in each group adjusts the indicated parameter for the raster section of the same number.
1	HORIZONTAL potentiometers	Adjusts final horizontal position.
2	VERTICAL potentiometers	Adjusts final vertical position.
3	DEPTH potentiometers	Adjusts final depth position.
4	HORIZONTAL potentiometers	Adjusts initial horizontal position.
5	VERTICAL potentiometers	Adjusts initial vertical position.
6	DEPTH potentiometers	Adjusts initial depth position.
7 & 8	WIDTH and LENGTH potentiometers	Adjusts WIDTH and LENGTH of each raster section.
9	SEQUENCE controls	Not used on this model.
10	FINAL potentiometers	Adjusts the final image rotation of each raster section.
11	INITIAL potentiometers	Adjusts initial image position of each raster section.
12	COMMUTATOR controls	Not used on this model.
13	R and B controls	Not used on this model.
	G control	Controls individual section intensity.
14	LENGTH CONTROL potentiometers	Adjusts the length of the corresponding numbered section. They should be adjusted in reverse order, #5 first and #2 last. Section 1 will use the time left after the other sections have been adjusted.
15	SECTION SELECT switches	This switch selects the number of raster sections to be used in a given animation.
16	COMMUTATORS switch	Selects the indicated Commutator chassis signal (S1) to be connected to the SCANIMATE FUNCTION SWITCH for monitoring on an oscilloscope, when S1 is in commutator position.

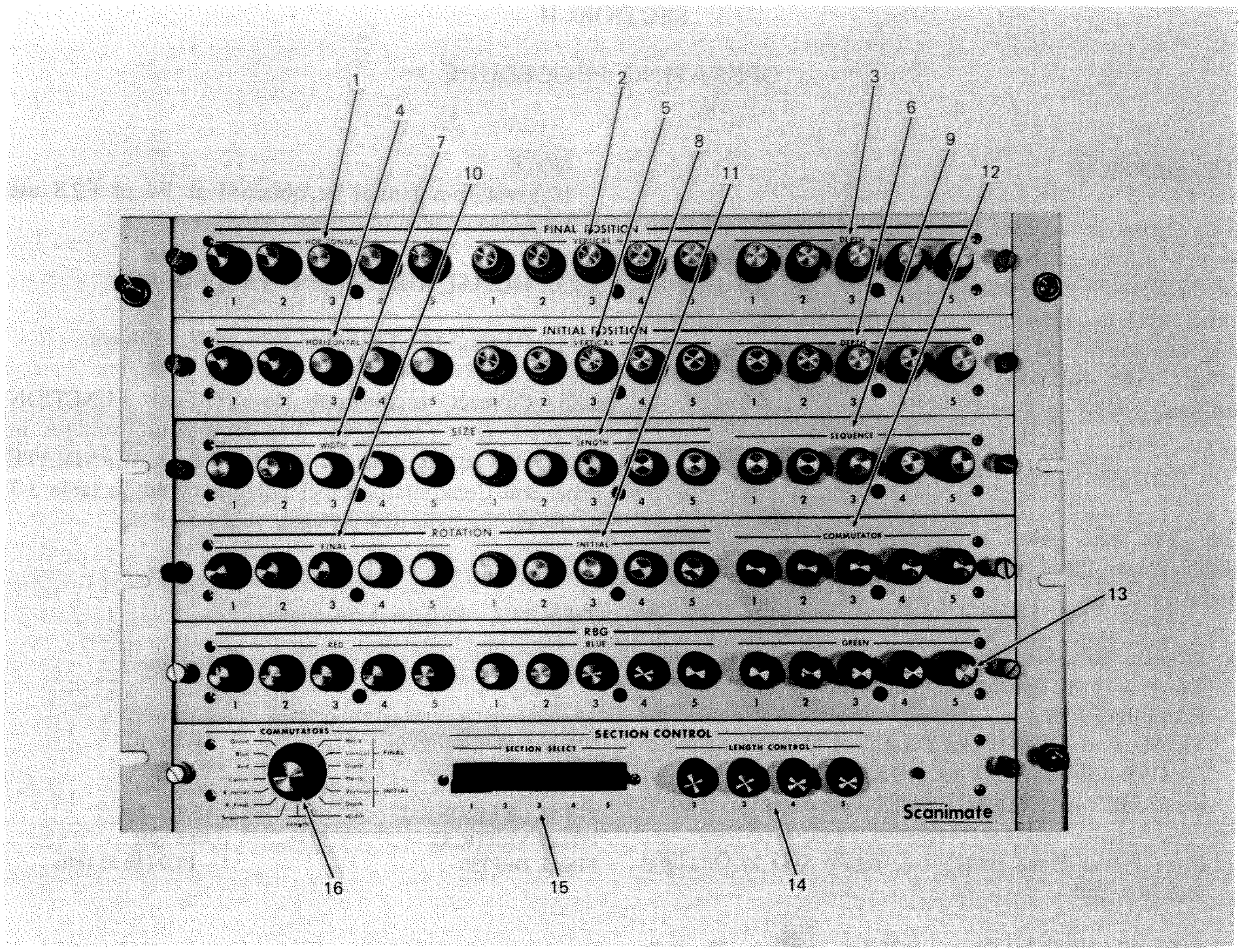


Figure 3–2. Commutator Panel Controls and Indicators

SECTION II

OPERATING PROCEDURE

3-5. GENERAL.

3-6. Operation of the SCANIMATE system consists of system interconnection, application of power, alignment of the artwork to be animated, selection and sizing of the raster sections, adjustment of the final and initial images, and adjustment of the animation sequence length and effects. The following paragraphs describe these procedures.

3-7. POWER-ON PROCEDURE.

3-8. The main power switch is located on the Monitor Table Power Panel (see figure 3-3). Power is applied as follows:

a. Position following SCANIMATE panel switches (see figure 3-1) as indicated: INITIAL-FINAL to FINAL, RAMP-BYPASS to RAMP, HORIZONTAL, VERTICAL, and DEPTH OSCILLATOR ON-OFF switches to OFF, and FIELD to NORM. Place Commutator Panel SECTION SELECT switch (see figure 3-2) to 5.

b. Place Power Panel switch (see figure 3-3) to On, light will glow red.

c. Place SCANIMATE Chassis POWER switch to On, light will glow.

d. Place light box power switch to On, light box will light.

3-9. SCANNER FOCUS PROCEDURE.

3-10. Place test pattern or other artwork in light box. Place Section Control chassis SECTION SELECT switch #1 to down position and adjust SCANIMATE chassis SIZE and POSITION controls to obtain a standard raster on the CRT.

3-11. Position light box forward towards scanner until the raster on the monitor fills the grid plate raster area. Center the artwork on the CRT by moving the light box laterally and the scanner vertically.

3-12. Adjust the scanner lens focus to obtain best focus of image on CRT, the focus may be improved with the Monitor chassis focus control. Connect oscilloscope to SCANIMATE chassis VIDEO jack and adjust to obtain 1 volt p-p video with lens aperture at F2.8 or F4.

NOTE
If 1 volt p-p cannot be obtained at F4 or F2.8 use next lower aperture setting.

3-13. INITIAL ADJUSTMENT PROCEDURE.

3-14. Position SECTION SELECT switch 5 down.

3-15. Connect oscilloscope to SYSTEM FUNCTION OUTPUT jack (23, figure 3-1) to measure voltages in range of +10 volts to −10 volts. Adjust SCANIMATE Panel and Commutator Panel potentiometers in table 3-3 to obtain the indicated voltages.

Table 3–3. Voltage Adjustment

Potentiometer	*Voltage*
All Commutator Panel potentiometers	±0.5 volt
INITIAL HORIZONTAL	±0.5 volt
INITIAL VERTICAL	±0.5 volt
INITIAL DEPTH	±0.5 volt
FINAL HORIZONTAL	±0.5 volt
FINAL VERTICAL	±0.5 volt
FINAL DEPTH	−10.0 (±0.5) volts

3-16. MONITOR CRT ADJUSTMENT PROCEDURE.

3-17. Adjust the Monitor Chassis Intensity control (see figure 3-3) so that with an undeflected trace there is only sufficient brightness to expose film without a halo effect.

CAUTION

Excessive brightness can burn the CRT phosphors and permanently damage the tube.

3-18. Adjust the SCANIMATE chassis SIZE controls to maintain a raster size which fills the grid plate raster area. Then readjust intensity with SCANIMATE chassis INTENSITY control. Obtain sharpest image possible using Monitor chassis FOCUS control.

3-19. RASTER SECTIONING PROCEDURE.

3-20. Place SECTION SELECT switch to position of the number of sections desired and turn all LENGTH control pots counterclockwise. For example, if artwork has three parts to it.

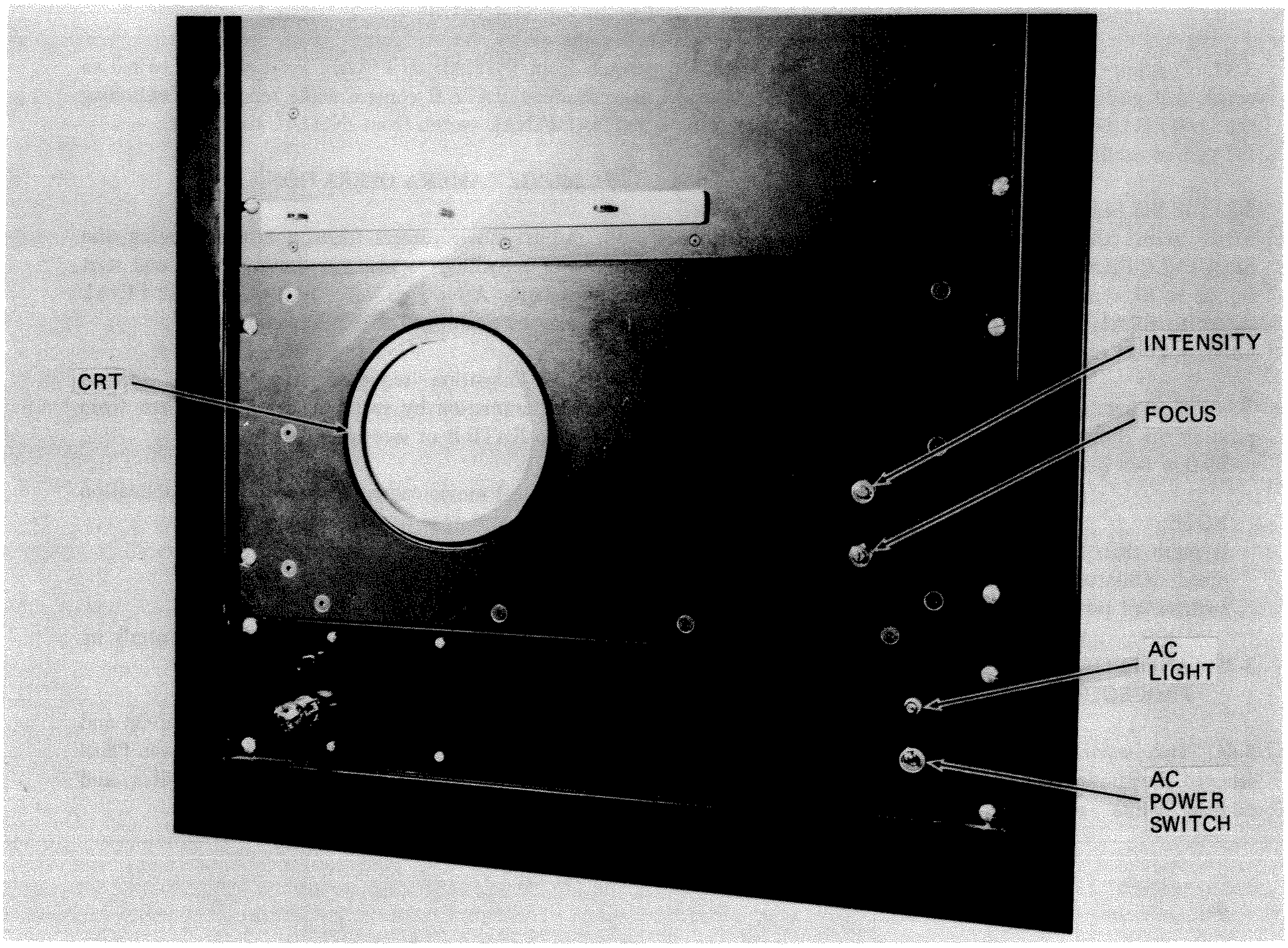


Figure 3–3. Monitor Chassis and Power Panel

NOTE
The sections are numbered from the top of the artwork down.

3-21. Adjust VERTICAL FINAL POSITION 3 to obtain a separation of section 3 from the rest of the raster and adjust LENGTH CONTROL 3 to obtain the desired size of section 3.

3-22. Adjust VERTICAL FINAL POSITION 2 to obtain a separation of section 2 from the remainder of the raster and adjust LENGTH CONTROL 2 to obtain the desired size of section 2. (Section 1 will consist of the space remaining after the other sections have been set.)

3-23. FINAL IMAGE ADJUSTMENT PROCEDURE.

3-24. Adjust the Commutator Panel FINAL POSITION, HORIZONTAL, VERTICAL, DEPTH, ROTATION, and SIZE controls for each section to position all sections in the arrangement desired at the completion of the animation sequence.

3-25. The entire presentation may be positioned using the SCANIMATE panel FINAL POSITION, SIZE, and ROTATION controls.

3-26. INITIAL IMAGE ADJUSTMENT PROCEDURE.

3-27. Adjust the Commutator Panel INITIAL POSITION HORIZONTAL, VERTICAL, DEPTH, ROTATION, and SIZE controls for each section to position all sections as desired at the beginning of the animation sequence.

3-28. The entire presentation may be positioned using the SCANIMATE Panel INITIAL POSITION, SIZE, and ROTATION controls.

3-29. OSCILLATOR ADJUSTMENT PROCEDURE.

3-30. Each oscillator functions and is adjusted in the same manner. Adjustment of the horizontal Oscillator only is described below.

3-31. The Oscillator ON-OFF switch is placed to ON and the INITIAL-FINAL switch is set to INITIAL.

3-32. Position the Ramp Select switch to the position which will give the desired oscillatory effect and adjust the AMPLITUDE and FREQUENCY controls to obtain the desired oscillation about the initial position.

3-33. If the beginning of the oscillation is to be synchronized with the animation sequence, position the SEQUENCE-FRAME switch to SEQUENCE; if the oscillation is to be synchronized to the frame rate, position the switch to FRAME; if the oscillation is not to be synchronized, position the Sync switch to OFF.

3-34. If either type of synchronization is to be used, position the Sync switch to either RIGHT or LEFT. The oscillation will begin at the side selected.

NOTE
If more than one oscillator is in operation, the combined oscillatory effect may be noted with the Sync switches all positioned to OFF.

3-35. ANIMATION SEQUENCE ADJUSTMENT PROCEDURE.

3-36. Two separate animation sequence rates may be selected. Position Rate switch to A and adjust RATE-A control while repeatedly switching INITIAL-FINAL switch from INITIAL to FINAL. Position Rate switch to B and adjust RATE-B control while repeatedly switching INITIAL-FINAL switch from INITIAL to FINAL.

3-37. MOVIE CAMERA OPERATION.

3-38. Adjust movie camera focus, aperture, framing, and frame rate according to manufacturer's manual and start movie camera. After two seconds, the INITIAL-FINAL switch may be positioned to FINAL.

3-39. The animation sequence rate may be changed during the animation by switching the Rate switch from RATE-A to RATE-B or vice-versa.

3-40. Turn off movie camera at end of desired animation time.

3-41. SHUTDOWN PROCEDURE.

3-42. Remove film from camera per manufacturer's instructions.

3-43. Position all switches as directed in Power-On and Initial Adjustment Procedures. Then place Power Panel POWER switch, SCANIMATE Panel POWER switch, and Light Box power switch to OFF position.

CHAPTER IV

THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This chapter describes the principles of operation of the SCANIMATE System. The description consists of a brief description of the overall system function, a description of the system operation at the block diagram level, and a description of the operation of the various printed-circuit cards in the system.

SECTION 1

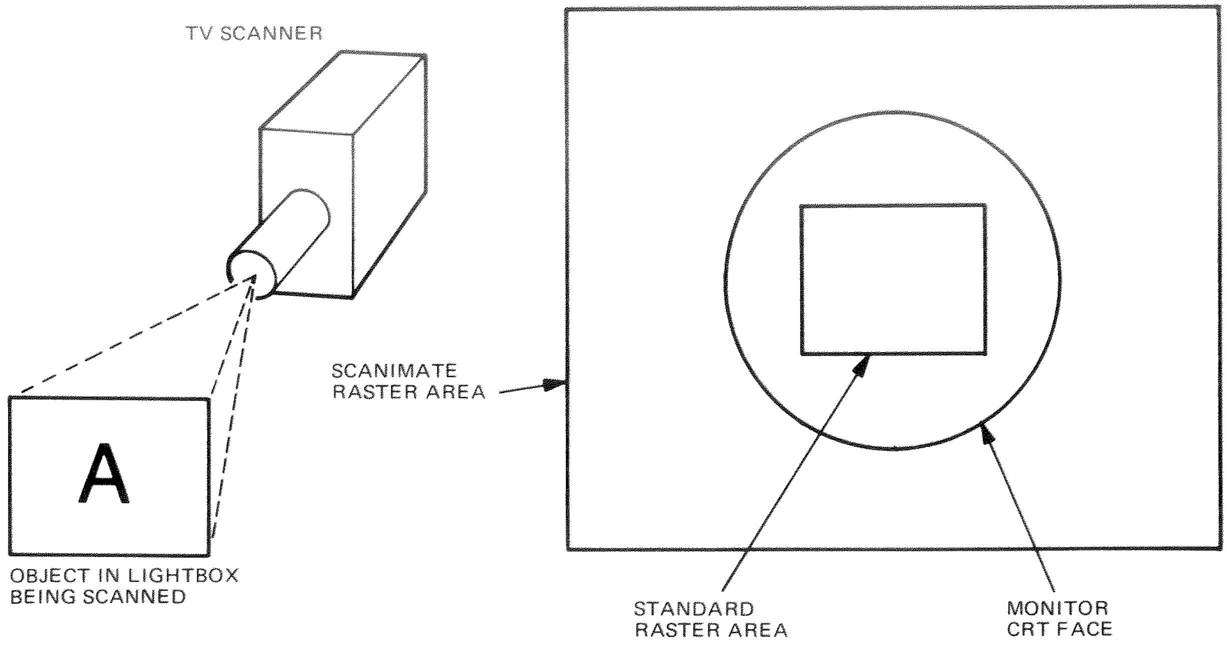
FUNCTIONAL DESCRIPTION

4-3. SCANIMATE OPERATION.

4-4. SCANIMATE is an electronic system which is used to animate a TV presentation. An XY camera converts the desired scene to video signals. These video signals are displayed on an XY monitor whose raster is synchronized with that of the pick up. The raster of the monitor, however, is modified by the SCANIMATE computer so that the video image may be in a different position, have a different size, or be in a different orientation from that viewed by the pickup. The SCANIMATE operator may select any combination of position, size, and orientation for the image and specify that as an initial image. He may then select another combination of position, size, and orientation and specify that as the final image. The SCANIMATE computer then automatically creates an animated transition from the initial to the final image. The animation effects may consist of any combination of zooms, lateral or vertical translations, rotations, increase or decrease in size, plasticizing, etc. The entire image may be animated or it may be divided into as many as five sections any or all of which may be individually animated. The animation may be performed at a linear or a sine wave rate or any combination thereof. The animated scene is recorded on film or videotape.

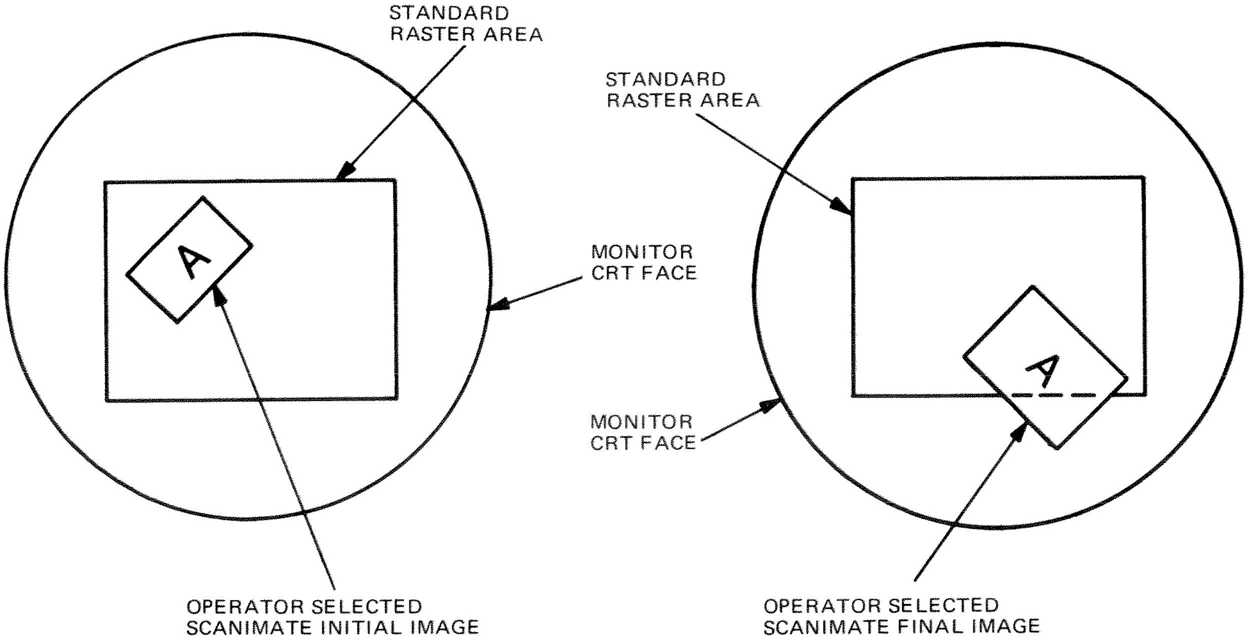
4-5. A standard TV creates video data representative of a scene by scanning the scene horizontally from top to bottom. The angular dispersion of the scan as compared to the number and height of scans defines the width and height dimensions of the picture. The video information thus obtained is displayed on a CRT screen using the same number of scans and the same picture height and width dimensions as those of the camera. SCANIMATE animations are created by using video from a TV pickup using fixed scan rate and picture dimensions. This video is displayed, however, on a monitor whose picture size may be varied greatly from that fixed size. Figure 4-1, A shows the raster of a standard TV scanner. B of the same figure shows the hypothetical area within which the SCANIMATE monitor may create a raster. In addition to the expanded area within which the raster may be projected, the SCANIMATE computer may create a raster of other than standard size and one which is not orthogonal with the standard raster. To create a SCANIMATE animation the operator adjusts the computer to create a raster of a desired size, shape, and rotation with the SCANIMATE raster limits of figure 4-1,B; this raster is called the initial raster. The operator then creates a second raster of any other size, shape, and rotation; this raster is called the final raster. Returning to figure 4-1,A shows the scanner forming a video image of the Character A. C of the figure shows that video displayed on the monitor using an initial image raster which is smaller than standard and which is rotated slightly counterclockwise. Section D shows this video displayed using a SCANIMATE final image raster which is still smaller than standard size but which is now longer in relation to its width than a standard raster and is rotated slightly clockwise.

4-6. When the operator has selected and viewed the initial and final images of the object being scanned he directs the SCANIMATE computer to perform an animated transition from the initial to the final image. SCANIMATE automatically creates the sequence of rasters required to transform the image displayed from that in figure C to figure D. The time required to perform the animation is variable as is the rate at which the transition is performed. A linear rate of motion, or a sine wave rate, or a combination of the two may be selected.



A. SCANIMATE PICKUP

B. SCANIMATE MONITOR



C. INITIAL IMAGE

D. FINAL IMAGE

Figure 4-1. SCANIMATE System Animation

4-7. SCANIMATE has provisions to divide the image scanned into as many as five sections and animate each of these segments individually. Figure 4-2 illustrates the scheme of this feature. A scene is scanned by the TV scanner, again using a standard scanning raster. SCANIMATE may be adjusted to display the resultant video on as many as five separate rasters. (The illustration shows three.) Each raster may be of any selected size excepting only that the total number of raster lines in all rasters must equal the number of lines in the standard raster. Section B of the illustration shows the three separate initial image rasters generated in SCANIMATE to handle the three picture elements; note that the rasters, and consequently the display, are outside the TV-safe area and will not be visible on the monitor. The same picture elements are shown in the selected final image raster display. Animation of this display would depict the picture elements ABC entering the viewing area at the top of the screen as small letters which move to the bottom of the screen while increasing in size.

4-8. Note that the object to be animated can perform a large number of motions. It can move into the viewing area from outside. It can move from inside the viewing area to outside. It can move from outside the viewing area across the viewing area and outside again. By moving from one raster size to another the object can be made to appear to change size which on the two dimensional monitor screen is interpreted as motion to or from the viewer. By varying the raster width-to-height ratio the object may be made to appear taller (narrower) or shorter (wider). The axes of the raster generated by SCANIMATE may be other than orthogonal thus tilting or rotating the image. The raster may start at the bottom and sweep to the top of the screen thus inverting the image. The scans may be directed from right to left thus reversing the image.

4-9. As described above animation consists of the transition from the operator-selected initial image to the final image. Considering the large number of motions which can be imposed and the fact that these motions can be of a linear, sine wave, or specified non-linear rate it is evident that SCANIMATE is a most versatile animation technique.

SECTION 2

SYSTEM OPERATION

4-10. GENERAL.

4-11. The following paragraphs outline the principles of operation of the SCANIMATE System at the block diagram level.

4-12. SCANIMATE DATA FLOW.

4-13. Interconnection and signal flow between the major SCANIMATE units is shown in figure 4-3. The SCANIMATE Console contains the system computer circuits and synchronization circuits. Control Panel inputs specify the particular animation which is to be performed. The computer generates horizontal and vertical sweep voltages for the system monitor which will animate the video display as specified.

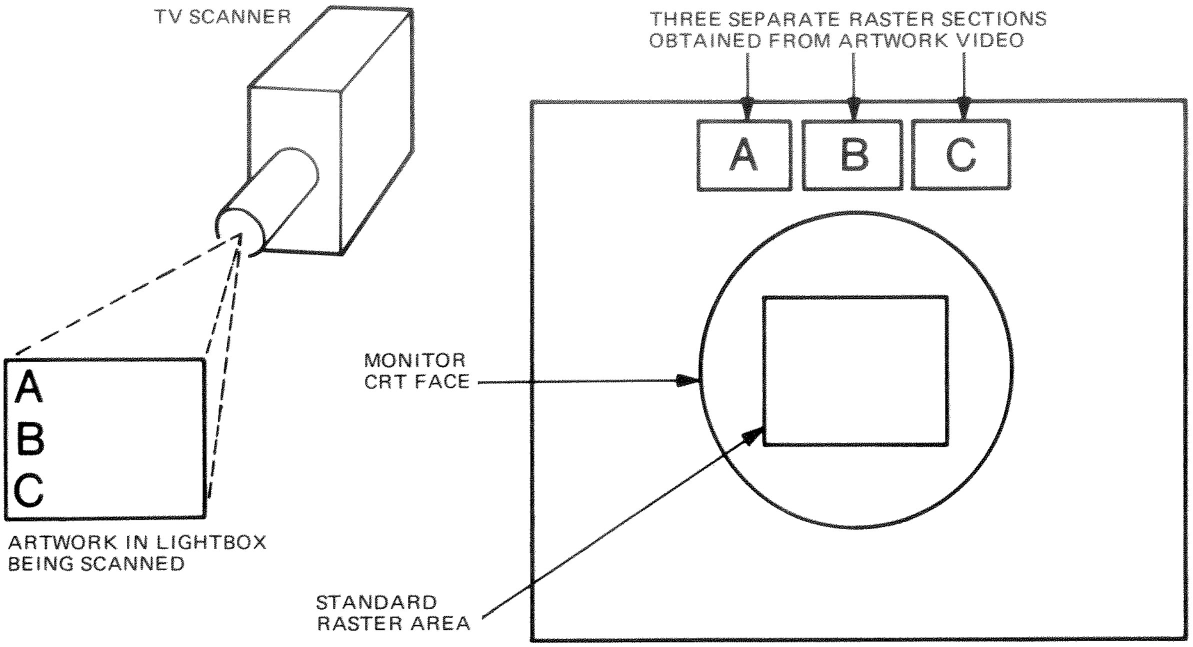
4-14. The video scanner uses sweeps generated by the Display Table video control. The sweeps are synchronized to the monitor sweeps by reset signals from the sync generator. The scanner video is amplified by a video amp in the Display Table and applied to the monitor.

4-15. The monitor display is filmed by the Monitor Table movie camera. The shutter position of the movie camera is monitored for synchronization purposes.

4-16. DESCRIPTION OF OPERATION.

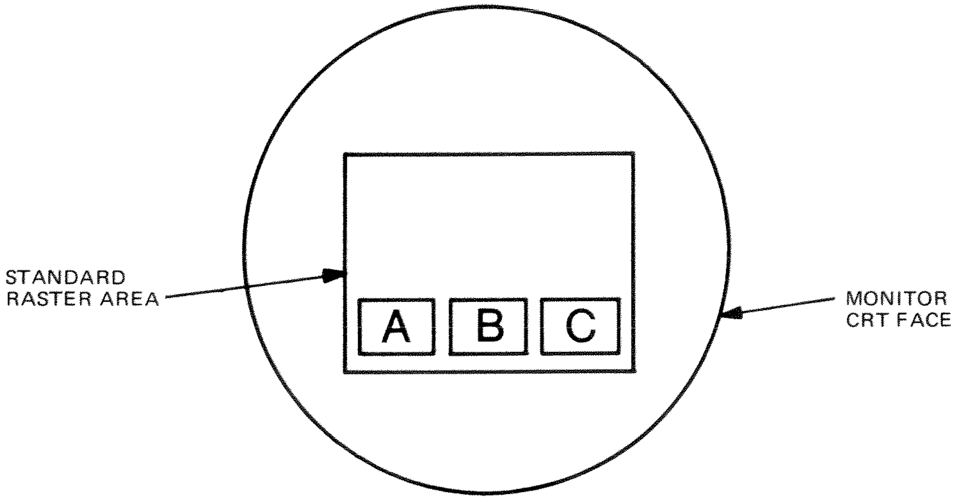
4-17. The block diagram of figure 4 - 4 shows in more detail the data flow and functioning of the SCANIMATE System. At the heart of the system is the Monitor CRT. The Monitor displays video from the TV Scanner using a Horizontal Sweep and Vertical Sweep generated in the respective channels. These two channels and their accessory circuits comprise the SCANIMATE Computer and create the SCANIMATE animation.

4-18. HORIZONTAL CHANNEL. The horizontal and vertical channels are quite similar in function so only the horizontal channel will be described in detail. The horizontal channel develops the monitor horizontal sweep voltage using several input signals. They are the initial



A. SCANNING ARTWORK

B. INITIAL IMAGE
RASTER SECTIONS OUTSIDE
CRT VIEWING AREA



C. FINAL IMAGE
RASTER SECTIONS
WITHIN VIEWING AREA

Figure 4-2. Sectioned Display

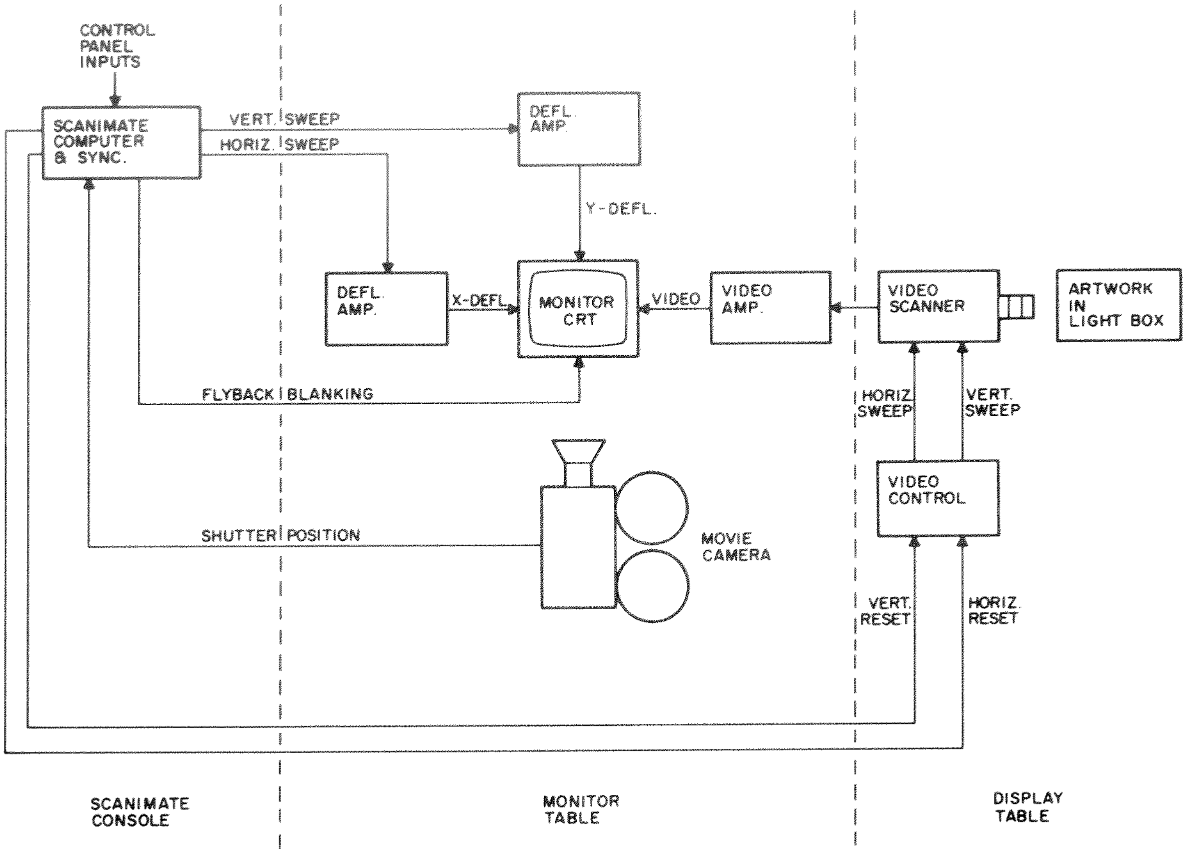


Figure 4–3. System Data Flow

horizontal position signal, the final horizontal position signal, and the horizontal raster signal. The initial and final horizontal position signals are the horizontal components of the initial and final image positions selected by the SCANIMATE operator. The raster signal is the output of the horizontal raster generator operating at 28.8 khz. At any one time the horizontal channel output is a mixture of two main signals, one of the position signals and the raster signal. The raster signal is a sawtooth which scans the CRT trace back and forth across the screen and the position signal selects the position on the CRT face from which the trace begins. Two raster generators are required to generate each channel's raster for reasons which will be explained later. For purposes of this discussion only the raster generators which are starred (*) in the diagram, need be considered and the multiplier immediately preceding those generators may be considered as having minimal attenuation. The raster generator is an integrator which is biased by the "size" signal and reset by the horizontal reset pulse. If the image is to be of a relatively large "size" the size signal is large and the integrator output between reset pulses will rise to a large value. If, on the other hand, the image size is small, the integrator output will be a ramp of less amplitude and a smaller sweep, and raster, will be generated.

4-19. The transition from the horizontal position of the initial image to the final image is accomplished by a multiplier controlled by the Animation Ramp Generator. The Ramp Generator is an integrator which produces a 10-volt to 0-volt ramp whose run-out time is continuously variable by the ANIMATION CONTROL SEQUENCE switches RATE-A and RATE-B (see figure 3-1). The multiplier like all SCANIMATE multipliers is essentially a variable attenuator whose attenuation is controlled by the input bias signal. Initially the attenuation is minimal and the initial position signal is the predominant one. As the ramp goes from its initial level toward its final level, the initial signal is increasingly attenuated and the final position signal comes to predominate. During this transition, which occurs over an adjustable period extending up to some seconds, note that the raster generator is continuously creating a 28.8 khz raster whose starting point is specified by the position signals. The output of the final position amplifier is applied to the Monitor Table hori-

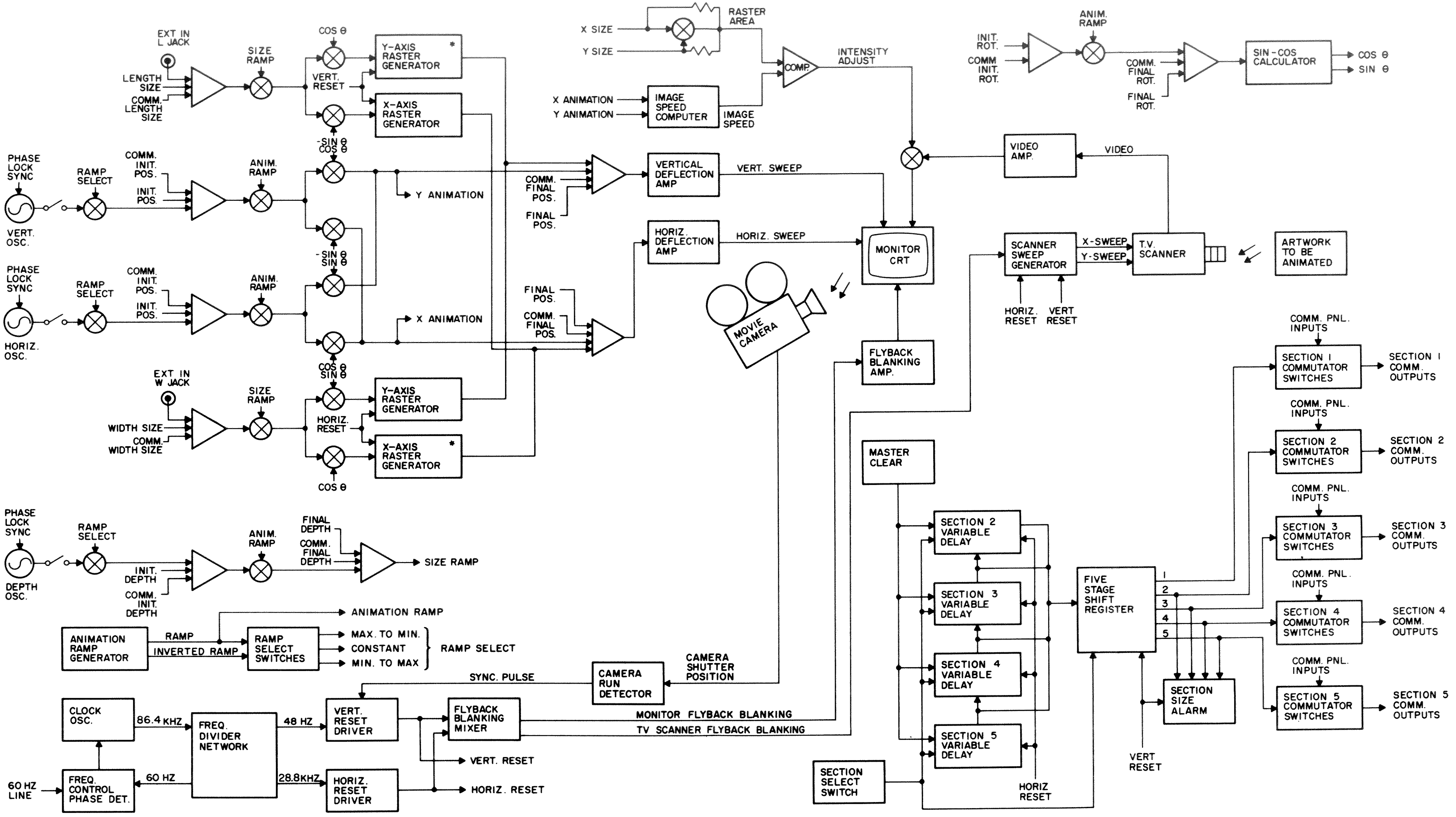


Figure 4–4. Detailed System Data Flow

zontal deflection amplifier and thence to the horizontal deflection plates of the Monitor CRT.

4-20. The major function of the horizontal channel is the generation of the horizontal raster superimposed on the position signal during its controlled transition. Note however that an additional signal may be superimposed on the raster, this being the horizontal oscillator output. The oscillator output is mixed with the initial position signal under control of another ramp-controlled multiplier. This multiplier is biased by any one of the three ramp select signals. The max-to-min signal is the 10-to 0-volt animation ramp, the min-to-max signal is the inverted -10-to 0-volt animation ramp, and the constant signal is a steady 10-volt bias. The oscillator output may be adjusted to frequencies from approximately 0.025 to 500 hertz and may also be adjusted in amplitude. The operator selects the oscillator output he desires and then selects the ramp with which he wishes to modulate the oscillator output. The effect of the oscillator signal when added to the initial position signal is to create an oscillatory initial position signal. It is apparent that the combinations of oscillator frequency and amplitude, and ramp type can give an infinite array of oscillatory motions to the initial position signal. Note that as the transition from initial position to final position is made under control of the animation ramp, the final image is without oscillation.

4-21. VERTICAL CHANNEL. The Vertical Channel operation is similar to that outlined above except the sweep rate is 48 hz. The raster is thus a 600 line raster with a 48 hz frame rate.

4-22. ROTATION OF AXES. Operation of the horizontal and vertical channels as described above is modified somewhat when rotation of the raster axes is in effect. The operator may select to rotate the raster in either direction. Controls on the SCANIMATE panel and on the Commutator panel provide for the insertion of initial image and final image rotations. Given that the raster is of dimensions x and y and that rotation θ is to be inserted, the size of the raster after rotation will be x and y. The dimension of x will be x cos θ – y sin θ and that of y will be y cos θ + x sin θ. This translation- of-axes change in size is performed by the four raster generators and the associated multipliers. Note that just as the size of the raster must be changed the animation initial and final positions will be similarly translated by the four multipliers interposed between the initial and final amplifiers in the horizontal and vertical channels. The multipliers in both cases are biased by cos θ and sin θ signals generated by the sine-cosine calculator. (Note the initial to final rotation transition is accomplished exactly as described above for other initial to final transitions.) The sine-cosine calculator is an integrator-comparator which integrates the input rotation bias and supplies a sine or cosine function to the channel multipliers.

4-23. DEPTH CHANNEL. The interrelationship between size and depth is as follows. The size of the raster and hence the size of the image is specified by the operator using the SIZE controls. Note, however, that the operator may also specify the depth (or distance from the viewer) of the presentation. On the two-dimensional TV screen, changes in depth (or distance) can only be depicted as changes in size. To accomplish this size variance, the size bias to the raster generators is modulated by the depth signal. As the animation proceeds from initial to final image, the depth change will modulate the bias to the raster generators and thus, the size of the raster. Note that the depth channel has an oscillator input which functions as described above.

4-24. VIDEO GENERATION. The video information displayed on the Monitor CRT is generated by the TV Scanner of the Display Table. The Scanner is a one-inch vidicon which uses 900 volts generated by the Display Table high-voltage supply. The vidicon uses sweeps generated by its own sweep generator under control of the Horizontal and Vertical Reset signals. Flyback blanking is also obtained from the Sync Generator. Sweep size in both x and y dimensions is continuously variable by the X and Y SIZE potentiometers. The vidicon scans the material to be animated and produces video in the 600-line frame, 48 frame-per-second format set by the reset signals. The video is amplified in the monitor Table Video Amplifier and passes thence through a multiplier to the monitor CRT where it is displayed.

4-25. The function of the multiplier is to adjust video intensity. There are two conditions where the intensity of the video is adjusted. The first is the case where the "area" in which the video is to be displayed differs in size from the "area" scanned by the vidicon. The system is adjusted so that when the video from the camera just fills the Monitor screen, the white-to-black tonal response of the monitor approximates the white-to-black tonal scale detected by the Scanner. If the animation in process required, for instance, that the video be displayed on a smaller area than the full screen then, since the amount of video information would remain the same, the overall image would be brighter and the tonal scale would no longer be true to that scanned. Also, if the video were displayed at a larger angle than that scanned, then the image would be overly dim and its tonal scale faulty. The intensity compensator provides an intensity adjustment to maintain the monitor intensity level in either of the above cases. Samples of the X (horizontal) and Y (Vertical) size signals are applied to a multiplier which computes the area over which the video is to be displayed. Accordingly, as the area differs from that scanned, the video intensity is adjusted. Note that in the case where a section or raster is reduced to what is effectively zero in one dimension, that is when either the X or Y size of the raster is minimized, the multiplier is bypassed and the other signal maintains video intensity at an acceptable level.

4-26. A second case where intensity variations would be of concern is the apparent diminution of image intensity due to image speed. During animation sequences where the image is moving at a rapid pace the image intensity appears to be diminished; this effect is due to the viewer's eye and not to an actual loss of intensity. Correction is made for this situation, however, by computing from the Horizontal and Vertical Animation signals an Image Speed signal. This signal, as is the raster area signal, is applied to the intensity compensator circuit.

4-27. SYNC GENERATOR. The sync generator circuit clocks and synchronizes the operation of the SCANIMATE system. The clock oscillator is locked at 86.4 khz by a phase detecting comparator. The clock output is applied to a series of flip-flops which function as a frequency divider network. The divider outputs are nominally 28.8 khz, 48 hz, and 60 hz. If the clock output drifts from 86.4 khz the 60 hz output of the network will reflect the drift. The 60 hz signal is compared to the 60 hz of power-line current and the difference is used to adjust the frequency of the oscillator. The 28.8 khz is applied to a single shot-driver circuit and thence to the system as the horizontal reset signal. The 48 hz is handled similarly, however the vertical reset signal is synchronized to the movie camera when the camera is running. The camera run detector is an integrator which is charged by the cumulative camera-shutter-open pulses from the movie camera. The detector output resets the vertical reset driver when the movie camera is running and has run long enough to reach the correct frame rate. The 48 hz and 28.8 khz signals pass through pulse shaping circuits and then are combined to generate the flyback blanking, or composite sync signal, which blanks the monitor tube face during the horizontal and vertical flyback periods.

4-28. COMMUTATOR SECTION. The commutator section enables the raster to be broken into as many as five sections each of which may be separately and individually animated. The commutator is effectively a five-position, fifteen-pole electronic switch. When any one position of the switch is enabled the circuit gates the fifteen signals to their respective outputs. There is a commutator panel input corresponding to each SCANIMATE panel input to the system; for instance the initial depth amplifier has an initial depth signal from the SCANIMATE panel and one from the commutator panel. The commutator consists of a five-stage shift register each stage of which enables one of the five section switches. The register is driven by four variable-delay monostable multivibrators. The section select switch specifies how many sections are to be used in a particular animation. If five sections are to be used the section select switch enables section 5 delay multivibrator. The section 5 delay M.V. is a variable circuit whose delay is set by the section 5 length control. The section 5 delay is triggered at vertical reset, and runs out its delay. The fifth stage of the register is set while the delay runs out. At the completion of the delay when the multivibrator returns to its stable state two things occur. Delay multivibrator four is triggered and register stage five is cleared and stage four is set. The register opens the section five switches and closes the section four switches thus changing from section five system parameters to section four parameters.

4-29. The section four switches are on until the section four delay runs out, then, as above, the register steps to section three. The operation of section three and two is similar. When section two runs out the two register is set to stage one and the section one switches are closed. The transistions from section to section can only occur at the end of a horizontal sweep. The end of stage one is signaled by the vertical reset signal which clears section one and begins section five.

4-30. When the vertical reset occurs the register must be set to stage one or a section size alarm will occur. The delay time of each multivibrator is individually adjustable and may be set to virtually any value, subject only to the requirement that section one must be in progress at vertical reset. This is assured by adjusting the delay times beginning at the last section and adjusting in sequence so that section one is set before vertical reset. The master clear circuit clears the commutator at system turn on.

SECTION III

PRINTED CIRCUIT THEORY

4-31. INTRODUCTION.

4-32. The following paragraphs describe the various printed circuit boards used in the SCANIMATE system. A brief description of some standard circuits which are widely used throughout the system precedes the description of the individual cards. The cards of each major unit are described separately. Location of the printed circuit cards is shown in figures 4-5 and 4-6.

4-33. STANDARD CIRCUITS.

4-34. Integrated circuits (IC's) are used throughout the SCANIMATE system as amplifiers, multipliers, and integrators. Field effect transistors (FET's) are used as switches in several circuits. Many circuits use complementary symmetry drivers to provide a double-ended output. Each of these special circuit applications is described below.

4-35. IC AMPLIFIER.

4-36. The integrated circuit amplifiers used are two-input operational amplifiers. An inverting and a non-inverting input are provided. Feedback to the inverting input is used to control the gain of the amplifier. The ratio of the feedback resistor and the amplifier input resistor determines the amplifier gain.

4-37. IC INTEGRATOR.

4-38. The integrators used in the SCANIMATE System are the IC amplifiers described above with capacitive feedback. Several integrators use a FET switch to short the integrating capacitor in the feedback path. The circuit thus integrates on command.

4-39. COMPLEMENTARY DRIVERS.

4-40. Where outputs of greater capacity than that provided by IC amplifiers are required complementary symmetry drivers are used. The two complementary driver transistors are across +15 and −15 volts and according to which of the two conducts, a near 30-volt swing is possible at the midpoint of the amplifier. Where this driver circuit is used with an IC amplifier the driver output is used as the source of the IC feedback.

4-41. FET SWITCHES.

4-42. Two types of FET switches are used in the SCANIMATE System. Both consist of two FETs, one in series with the input and one in parallel. The series FET is a low resistance path when a signal is to be gated through the switch and a high resistance when the switch is to be open. The parallel FET is a high resistance to ground when the switch FET is gating the input. When the switch is open the parallel FET provides a low resistance path to ground for the input.

4-43. The first type of FET switch uses two P-channel type FETs, hence to have one FET switched into conduction and the other out of conduction requires two out-of-phase inputs.

4-44. The second type of switch uses one P-channel type and one N-channel type FET. Only a single input is needed to turn on one FET and simultaneously turn off the other.

4-45. PRINTED CIRCUIT BOARDS.

4-46. Descriptions of the printed circuit boards used in the various consoles are provided in the following paragraphs. The cards are grouped by console.

4-47. SCANIMATE CONSOLE

4-48. Printed circuit boards used in the SCANIMATE chassis and the commutator chassis are described below.

4-49. X AND Y CHANNEL BOARD. The horizontal and vertical channels both use the same card. Operation of the board (SM-101) is as follows.

4-50. The size, commutated size, and external size signal from the EXT IN jack are applied respectively to pins 22, Z, and 21. The signals are applied to summing amplifier IC1 whose output is available at test point TP1. That output is applied to pin 9 of multiplier IC2. Applied to pin 4 of the multiplier is the depth ramp from input pin 20. The multiplier output on pin 14 and 2 is amplified by IC3 and applied to output pin 19. The signal passes through the appropriate AXIS potentiometer and the FIELD switch and is applied to input pin Y. This input is one of four to pin 2 of amplifier IC4. Also applied to IC4 are commutated final position, raster generator, and the animation output of amplifier IC10. The four inputs are applied to input pin 2 of the amplifier and bias output driver Q1-Q2. The driver output may be sampled at test point TP3 and is applied to card output pin 16. The signal from pin 16 passes through the channel GAIN adjust and is applied to amplifier IC5 from card input pin 17. Also applied to IC5 is the position signal from card input pin 18. The amplifier output biases driver Q3-Q4 whose output at TP4 and pin 13 is the channel output.

4-51. The animation input to IC4 is obtained as follows. The output of the appropriate channel oscillator is applied to card input pin B and thence to multiplier IC6. The other multiplicand is the ramp select signal on pin 4. The oscillator output is modulated by the ramp select signal and is applied to amplifier IC7. The amplifier output may be sampled at TP5 and is applied to card output pin A. The signal on pin A passes through the OSCILLATOR ON-OFF switch and returns to card input pin 10 and FET switch Q5-Q6. When the switch is enabled (refer to FET Switch Theory of Operation) amplifier IC8 sums the oscillator output with its other inputs. Also applied to the input of IC8 are the initial position and commutated initial position signals on input pins 4 and 3 respectively. The output of IC8 is applied to multiplier IC9 and is also available to the OUT jack through the FUNCTION SWITCH (25, figure 3-1) from card output D.

4-52. The other input to the multiplier is the animation ramp on pin 4 of the IC. The multiplier output is amplified by IC10 and is applied to amplifier IC4 as previously described. The amplifier output may be sampled at TP7 and is applied to card output pin C where it is available for use in the intensity compensation circuit.

4-53. DEPTH (Z) CHANNEL BOARD. The Z channel board (SM-100) contains the animation ramp generator and size ramp generator circuits. Operation of the board is as follows.

4-54. The ramp upon which all SCANIMATE ramps are based is generated in integrator circuit IC2. IC2 is a standard amplifier with capacitive feedback by C3. Input to the amplifier is from IC1 which is biased by a rate signal from one of the two RATE switches. The output, however, is shorted out by FET switch Q3 except when the INITIAL-FINAL switch is positioned to FINAL. +5 volts from the switch biases Q1-Q2 to switch Q3 out of conduction. The integrator output is applied to two circuits, first to amplifier IC3 and from output pin 20 through the RAMP-BYPASS switch in the RAMP position to the input of driver Q4-Q5 at input pin 17. The output of Q4-Q5 is applied to IC5 and then IC6 and then to drivers Q8-Q9. The driver output may be sampled at TP2 and is available as the animation ramp at card output pin E. The ramp is of −10 to 0 volts and of duration determined by the RATE switch input to IC1.

4-55. The integrator output to IC3 is inverted, limited to 4 volts by zener diodes D2 and D3 in order to prevent overloading IC4 which is designed for no more than a +5 to −5 volt input swing. After being detected by IC4 and Q6 the signal is applied to output pin 7 as the sequence gate. The sequence gate is also applied to amplifier Q7 and inverted. The inverted sequence gate is applied on card output pin 6. The two outputs on pins 7 and 6 are used to drive FET switches requiring dual inputs.

4-56. The size ramp generator receives as its first input the depth oscillator output at pin B. The oscillator input is applied to multiplier IC7 whose other multiplicand is the ramp select signal. The ramp select signal modulates the oscillator signal. The multiplier output is amplified by IC8 and applied to output pin 1. The DEPTH OSCILLATOR ON-OFF switch determines if the signal shall be returned to input pin 8. The oscillator input on pin 8 is gated by FET switch Q10-Q11 using dual inputs from the sequence gate signals described above. When the signal is allowed to pass, it is summed by IC9 and applied to multiplier IC10. Also applied to IC9 are the initial depth and commutated initial depth. The amplifier output is multiplied by the animation ramp. The output of IC10 is amplified by IC11 and then summed with the sequence ramp signal, the final depth signal, and the commutated final depth from card input pins D, 3, and 2 respectively. The summed signals are amplified by IC12 and at card output pin C form the size signal.

4.57. SYNC GENERATOR BOARD. The Sync Generator board (SM-105) generates an 86.4 khz signal used to provide all SCANIMATE system synchronization frequencies. The 28.8 khz horizontal sweep frequency and 48 hz vertical sweep frequency are generated here from the 86.4 khz. Operation of the board is as follows.

4-58. Transistors Q6 and Q5 comprise the 86.4 khz oscillator. The oscillator output is amplified by driver Q11 and applied to frequency dividers. The oscillator frequency is maintained at 86.4 khz by a phase detector. The detector detects any difference in frequency and phase between a 60 hz signal generated from the oscillator 86.4 khz output and 60 hz line voltage which is the reference frequency via a 60 hz reference step down transformer located in the SCANIMATE chassis.

4-59. The reference 60 hz enters the board on pin X and is squared by amplifier IC2. The squared 60 hz is applied to the gate input of FET switches Q1 and Q2. Applied to the drain inputs of Q1-Q2 is a 60 hz signal obtained from the frequency divider. This 60 hz has also been squared by amplifier IC1. FETS Q1 and Q2 switch on and off at the 60 hz rate of the reference voltage. When the reference voltage and the frequency divided voltage are both at exactly 60 hz and are 90 degrees out of phase the output of the detector will be one quarter cycle of

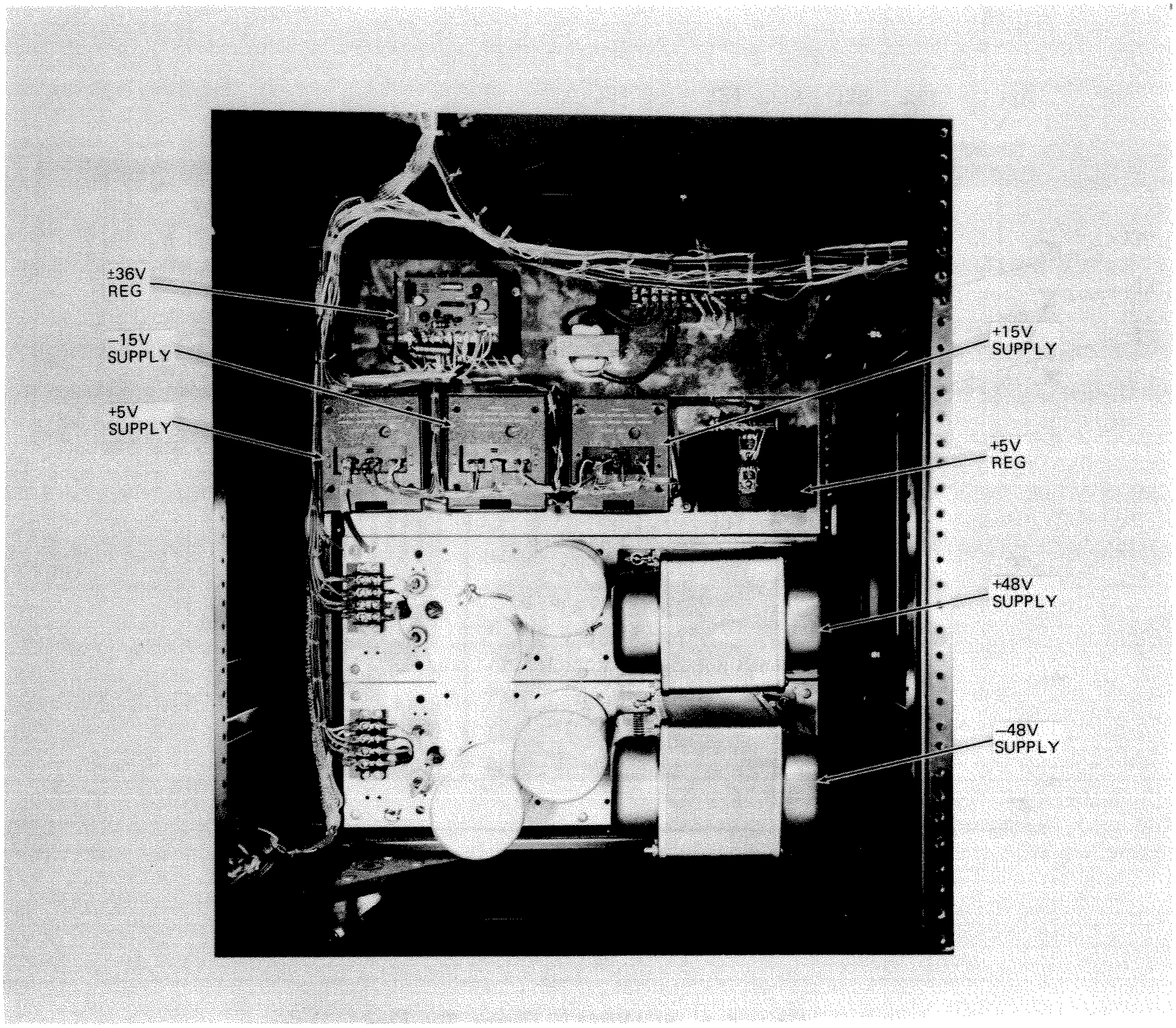


Figure 4–5. Monitor Chassis, Power Supplies

positive conduction, one quarter cycle of negative conduction, and one half cycle of nonconduction.

4-60. This signal applied to amplifier IC3 produces an output dc level of zero volts which is felt at the input of amplifier IC4. Amplifier IC4 and drivers Q3-Q4 drive the light source of Raysistor CK1114. This device is a resistor whose resistance is a function of the amount of light emitted by its light source. That is to say the device transduces voltage to resistance. Potentiometer R19 is adjusted so that with a zero output from IC3 amplifier IC4 will bias the Raysistor to produce 2.7 kilohms resistance across its resistance. The oscillator is adjusted with R40 so that when the Raysistor produces 2.7 kilohms the output frequency will be 86.4 khz.

4-61. If the output frequency of the oscillator drifts from 86.4 khz the 60 hz derived therefrom will drift commensurately and the output of the detector will no longer be one quarter positive and one quarter negative. According to the direction of drift the detector output will average out a slight negative or slight positive voltage at the output of IC3. This voltage will, through IC4 and Q3-Q4, change the resistance of the Raysistor and hence the frequency of the oscillator.

4-62. The oscillator 86.4 khz output is applied to divide-by-3 counter IC10A and IC9B and produces 28.8 khz which is applied to IC9A and Q18. The input to IC9B is divided down by IC9B, IC9A, and IC14A, IC15, and IC16A to produce 48 hz which is applied to Q24. The

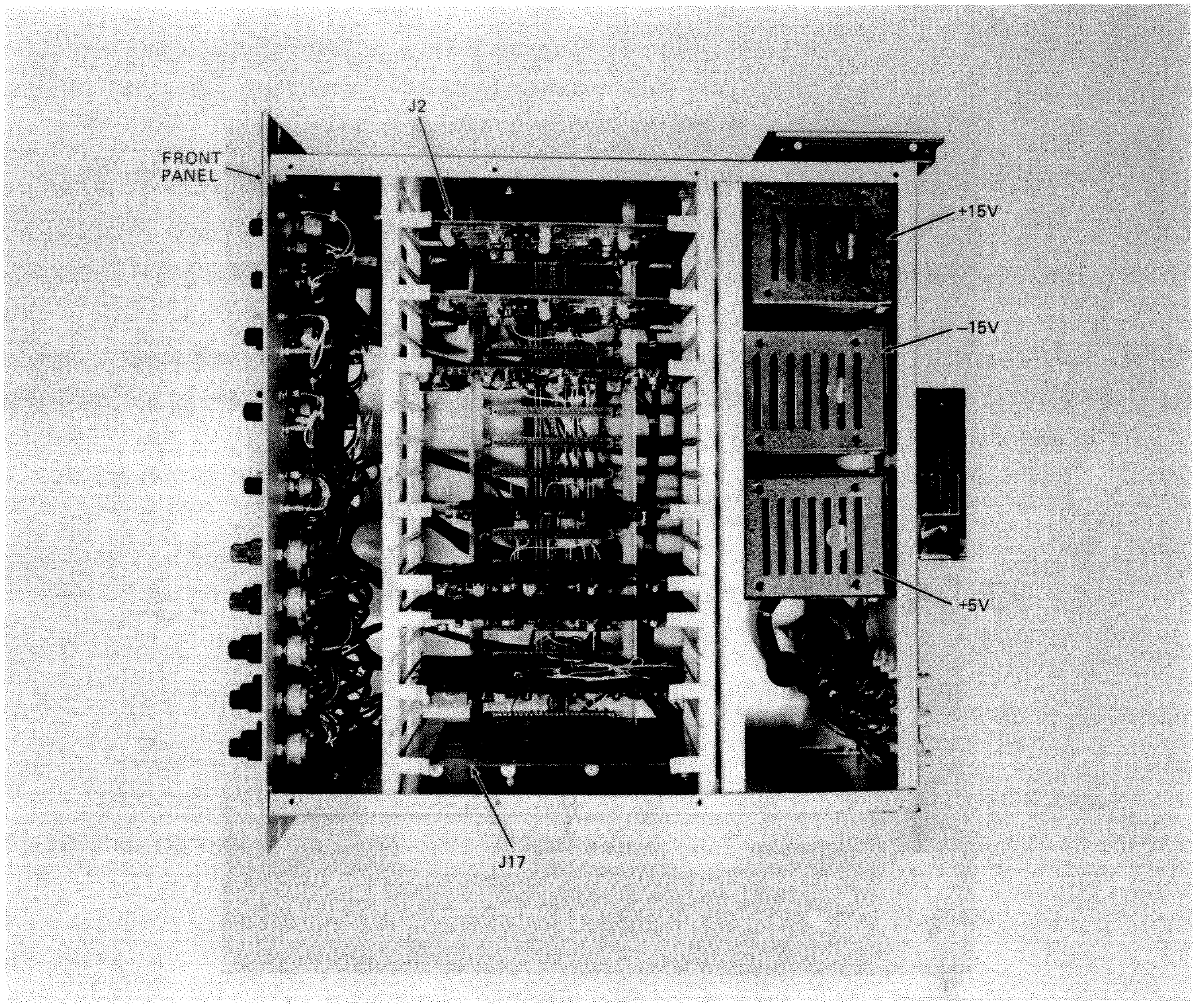


Figure 4–6. SCANIMATE Chassis, Top View

output of Q24 is applied to one shot IC17A and thence to Q9. The 28.8 khz which is biasing Q18 is similarly applied to IC12A and Q10. The outputs of Q9 and Q10 are mixed and together form at pin T the TV Scanner Flyback Blanking signal. The 48 hz output of Q24 is also applied to IC17B whose output, amplified by Q26, forms the 48 hz Vertical Reset. The 28.8 khz output of Q18 similarly triggers one shot IC12B and after being amplified by Q19 forms the inverted Horizontal Reset signal at pin D. The output of Q19 is also inverted by Q20 for use where required in that form.

4-63. The Vertical Reset signal is synchronized to the Movie Camera shutter to prevent filming the Camera Shutter Bar. The Camera Shutter Position signal is applied to pin A. The shutter opening is indicated by a negative pulse which across Q22 toggles one shot IC13A on and which across Q21 enables AND gate IC18A. The output of detector IC11 is also high so that IC18A passes the pulse and clears flip-flop IC16B. The low output of IC13A biases Q12 into conduction and C32 begins to charge. When C32 charges, detector IC11 changes state and disables IC18A ceasing all clearing pulses until the movie camera stops; C32 discharges and the movie camera starts again. The positive going, trailing edge of the IC13A output pulse triggers one shot IC13B. Q23 amplifies the trailing edge of the IC13B output pulse whose timing relative to the input pulse from the camera shutter is adjusted by R97 to eliminate shutter bar. The pulse output of Q23 is one input to gate IC18B. The other input to the gate is from one shot Q16-Q17 through amplifier Q15. The one shot is triggered by IC11 changing state when C32 has been charged. At the first camera shutter opening after C32 has charged IC18B will pass a series of pulses. The first pulse will set flip-flop IC16B and produce a pulse from pulse shaper Q27 which will clear dividers IC14A, IC15 and IC16A. Synchronization of vertical reset occuring only once during each camera run is ensured by the charge on C32.

4-64. SYNCH GENERATOR.

4-65. Raster characteristics, such as number of lines, lines per second, and interlacing, necessitate different sync requirements for filming and television. The synch generator circuit (SM-105A) provides the sync necessary for television by various available connections within the circuit. Refer to the synch generator schematic diagram for television sync connections. For operation of the synch generator, refer to the sync generator board operation as they are functionally the same.

4-66. SYNCH AND SIMULATOR. The synch and simulator circuit (SM-125) senses camera shutter position and supplies a synch signal to the sync generator circuit (SM-105). It also contains a circuit to simulate the synch signal without camera operation. Light is reflected by the camera shutter to a photo FET which produces a 50 millivolt pulse that is applied to the inverting input of comparator IC1 from pin F of the board. The output of IC1, a 3 volt pulse, is the camera shutter position synch signal. It is applied to the sync generator circuit through the closed contacts of the Camera Simulate Switch (S2) on the front panel. The synch signal is simulated by pressing switch S2. When S2 is pressed multivibrator IC2 generates the simulated signal which is now applied through driver Q1 and switch S2 to pin 0 of the board and to the sync generator circuit.

4-67. ANIMATION OSCILLATOR BOARD. All three channels, horizontal, vertical, and depth, use the same type of oscillator board. Operation of the board (SM-107) is as follows.

4-68. The animation oscillator consists of integrator IC3 and a shaping circuit consisting of amplifier IC4 and Zener diodes D3 through D12. IC3 and drivers Q5-Q6 function as a sawtooth generator whose output is applied to amplifier IC4. Feedback for IC4 is imposed on the parallel Zener network of D3 through D12. As the output of IC4 increases from zero volts the feedback is initially across resistor R35, but as the output voltage increases first the 3.3-volt Zener breaks down, then the 5.1-volt, then the 6.8-volt, etc. As each Zener breaks down another resistance is added in parallel to R35 and the feedback increases and gain thus decreases incrementally five times. This change in gain produces from the sawtooth input a roughly sinusoidal output which is amplified by drivers Q7 and Q8. The output from the drivers is applied from pin 2 to the AMPLITUDE adjust and returns to the board at pin 17. The amplitude adjusted is amplified by IC5 and drivers Q11 and Q12 and is available to the respective channels at pin 20.

4-69. The frequency of the sawtooth generator is set by the external FREQUENCY adjust which provides a positive bias to the board at pin 1. The bias is driven by IC1 and applied across FET Q4 to the input of the integrator IC3. The output of IC1 is also applied to IC2 where it is inverted and, as above, is applied across FET Q2 to IC3. FET switches Q2 and Q4 function to switch the input bias to integrator IC3 alternately positive and negative. The output of IC1 and then the output of IC2 is switched into IC3.

4-70. As the output of IC3 rises to its maximum positive value that output, tapped from between Q5 and Q6, is applied to detector IC6 and thence to Q9. The low output of Q9 sets IC1A of flip-flop IC1A-IC1B. The high output of IC1A gates Q2 off and the low output of IC1B gates Q4 on and switches the polarity of the input to IC3. IC3 now integrates to produce a negative output which when it rises to sufficiently high amplitude will bias IC7 and Q10 to switch flip-flop gate IC1B to a high output. The high output of IC1B gates Q4 off and the low output of IC1A gates Q2 on thus again reversing the polarity of input to IC3. IC3 thus receives an input of one polarity which it inverts and integrates, the integrated output rises to a certian level and then causes the polarity of the input to the integrator to be reversed whereupon the process repeats itself.

4-71. Potentiometers R2 and R1 adjust the level at which the output of IC3 effects triggering of IC1A or IC1B. IC1C and drivers Q15, Q16, and Q17 gate +15 volts across the output of IC1 and −15 volts across the output of IC2 when either mode of phase lock synchronization is to be used. This large amplitude input to integrator IC3 insures proper phasing of the integrator input when a low amplitude frequency adjust input is in effect.

4-72. INTENSITY SECTION BOARD. The intensity section board (SM-106) generates the monitor blanking and TV scanner blanking pulses. It also provides blanked video to the SCANIMATE panel VIDEO jack. Provisions for operation of a three color light box are also on this board. Operation of the board is as follows.

4-73. One shots IC1A and IC1B are triggered by each positive-going edge of the vertical reset and horizontal reset pulses respectively. The output of each flip-flop is applied to a driver and then to one input of OR gate IC2A. The OR gate output is inverted by IC3D and is the

TV scanner blanking The output of the OR gate is also applied to amplifier IC3A and then to OR gate IC2B. Gate IC2B also is activated by the Section Blanking signal. The gate output is inverted and forms the Monitor Blanking signal. Note that the Monitor is blanked between sections but the TV Scanner is not.

4-74. The video input to the board is amplified by Q7. The output of Q7 is superimposed upon the intensity signal derived from the INTENSITY potentiometer. The bias applied to pin C causes conduction of IC4 and its associated driver Q3-Q4. The fixed-gain amplification of the fixed-level input signal produces a constant level intensity signal upon which the video rides. Both signals, however, are blanked by the TV Scanner Blanking which is applied with them to amplifier IC5 and then to drivers Q5-Q6.

4-75. RASTER GENERATOR.

4-76. The raster generator circuit (SM-103) consists of two integrators with timed reset which controls the horizontal and vertical raster ramp output by the dc input level. Functionally, both horizontal and vertical circuits are identical except the vertical circuit has a lower gain.

4-77... The 28.8 khz, horizontal reset input pulse triggers Q3, through drivers Q1 and Q2, which short circuits integrating capacitor C2 in the IC2 feedback path to generate the sawtooth waveform. The dc, width input is applied to the inverting input of IC2 through non-inverting, input follower IC1. When the IC2 output is positive Q4 conducts and when it is negative Q5 conducts to supply the horizontal ramp output at TP1 and pin 5 of the card.

4-78. The frequency of the vertical reset input pulse is 48 khz for film and 60 khz for television. The vertical ramp output at pin 18 can be monitored at TP2.

4-79.. COMMUTATOR PANEL.

4-80. The Commutator Panel consists of five identical Commutator chassis and a Section Control chassis.

4-81. COMMUTATOR PANEL. Five commutator Panels are used in the Commutator Chassis. All panels are of identical construction but have differing front panel markings. Each panel is effectively a three-pole five-position switch with an amplifier on the output of each pole. Operation of the panel (SM-102) is as follows.

4-82. FET pairs Q1-Q2, Q3-Q4, Q5-Q6, Q7-Q8, and Q9-Q10 each form one position of one of the three five-position switches, their output is summed by IC1 and drivers Q11 and Q12. Each switch receives a +10 volt to −10 volt signal from the associated potentiometer, an external input to each switch is also available (on pins 2, B, 3, D, and 5). Only one of the switches at a time is turned on and all others are turned off. Note that the gate input which controls a given switch position controls the corresponding switches in the second and third set of switches. That is, Section 1 Gate on pin F controls not only Section 1 switch Q1-Q2, but also switches Q13-Q14 and Q25-Q26. Thus three switches on five commutators are turned on simultaneously and fifteen separate commutated signals are available at the appropriate points throughout SCANIMATE. The Section 1 switches are all gated simultaneously, then Section 2 is gated, then Section 3, 4, and 5. A test point is available at the output of each driver circuit.

4-83. SECTION CONTROL PANEL. The Section Control Panel generates the signals which operate the switches in the Commutator Panels. In addition the section blanking signal is generated here and the Section Caution light and its associated circuits are here. Operation of the Panel (SM-104) is as follows.

4-84. The main circuits of the Panel are four single-shot multivibrators and a five-stage shift register. Transistors Q16 through Q20 comprise one single-shot which is identical to the three above it. ICs IC1, IC2, IC3, IC4, and IC6 form the shift register. The shift register stages are: IC1 forms stage 5 and generates the Section 5 output, IC2 stage 4 and Section 4, IC3 stage 3 and Section 3, IC4 stage 4 and Section 4, and IC6 stage 5 and Section 5. Pin 13 on all flip-flops is the clear input. The register has only one stage set at any given time. Considering all five sections to be in use the operation is as follows. SECTION SELECT switch S1A is closed and all other switch segments are open (as shown on the schematic). Only one switch of the five SECTION SELECT switches may be closed and that switch connects the Vertical Reset signal as a trigger to the delay single-shot of the selected section. The negative-going edge of the reset signal drives the single-shot out of its stable state. The period of the single-shot is set by the LENGTH CONTROL pot (Potentiometers R71 through R74 set the period of the delay for Sections 5 through 2 respectively.) The output of the single-shot to the IC amplifier is normally high. During the delay the output is low and at the completion of runout it goes high again.

4-85. The negative-going edge when the first single-shot is triggered sets the associated OR-gate flip-flop. The output of that flip-flop is applied to the appropriate output pin. When the single-shot runs out, the positive-going edge turns on the associated transistor (Q20, Q15, Q10, or Q5) and the output of that transistor and the horizontal reset together reset the flip-flop of that stage. The reset flip-flop triggers the single-shot of the next stage. The flip-flop of that next stage is set and will be reset upon run-out of its single-shot. Note that when the flip-flop is reset the output of the resetting AND gate also is applied to OR gate IC8. The gate is part of a flip-flop which will gate the section signal to Q24. Q24 resets flip-flops IC11A and IC11B. Flip-flop IC11A is toggled by the horizontal reset pulses. The negative edge of the second horizontal reset pulse after IC11A is reset by Q24, sets flip-flop IC11B. thus the output of IC11B at pin H is a negative pulse, two horizontal lines in width, occurring at the end of each section.

4-86. Each successive stage of the section control functions as above until section 1 runs out. If, when vertical reset occurs, any section but section 1 is still in progress then flip-flop IC7 will be set and the Section Caution light will be illuminated. Note that if any of the four sections 2 through 5 are still set then IC9 will have a low input which will set flip-flop IC7 and cause the Section Caution light to light.

4-87. CAMERA TABLE.

4-88. Printed Circuit boards used in the Camera Table are described below.

4-89. CAMERA HEAD.

4-90. VIDEO PREAMPLIFIER.

4-91. The camera video preamplifier circuit (SM-126) accepts the video signal from the Vidicon, amplifies, and conditions the signal for application to the monitor circuits.

4-92. The video signal is amplified by a cascode amplifier consisting of Q1 and Q13. Emitter follower Q2, an isolation stage, couples the signal from Q13 to the peaking amplifier Q3 and Q4 which amplifies the high frequencies. The signal is further amplified by voltage amplifier Q5 and Q6 and applied to one gate of the dual gate FET, Q7. Resistor R23 is the low frequency response adjustment and C10 is the high frequency roll off adjustment of the amplifier stage which has a frequency response from dc to 40 mhz.

4-93. Dual gate FET Q7 functions as an automatic gain control by gate bias adjustment. The signal from Q7 is amplified by voltage amplifier Q8 and coupled to the monitor circuits through emitter followers Q10 and Q12. The video output is blanked and damped during sweep retrace by the blanking pulses at the base of Q11 which are then coupled to switching transistor Q9. The blanking level at the emitter of Q9 is adjusted by potentiometer R40.

4-94. BLANKING AND PROTECTION BOARD. The blanking and protection circuit (SM-109) provides a blanking pulse to blank the vidicon tube during the return trace. At the end of the horizontal sweep, a positive voltage pulse is applied to the cathode, pin 7, of the vidicon tube which biases the tube off. The blanking pulse is produced when the blanking input and the X and Y axis sweep voltage inputs are applied to the blanking and protection circuit.

4-95. The X and Y axis sweep voltages from the deflection yoke, coupled through capacitors C4 and C1, are amplified by Q2 and Q4, respectively. The outputs of Q2 and Q4, coupled through C5 and C2, are rectified by diodes D5 and D2 to provide a positive voltage at the cathodes of diodes D6 and D3. This condition will turn on switch Q3 which supplies a ground for the emitter of switch Q1.

4-96. When the input blanking level is positive, Q1 conducts and a ground level is applied to the cathode of the vidicon tube, turning it on. When the blanking input pulse goes to zero, Q1 is turned off and the vidicon cathode goes to +36 volts. The tube is blanked for the duration of sweep retrace by this pulse. Also, failure of either the X or Y sweeps will cause the vidicon to be blanked.

4-97. CAMERA CONTROL.

4-98. RAMP GENERATOR CIRCUIT. The ramp generator circuit (SM-113) generates a ramp waveform for the X and Y axis sweep voltages. The circuit consists of an operational amplifier, FET switch, complementary emitter followers, input switch, and a level converter. Only the X-axis circuit will be explained, since both sweep generator circuits function identically, except for the time duration of the ramps.

4-99. A dc voltage is applied to the inverting input of operational amplifier IC1. Half of this voltage is applied to the non-inverting input by voltage divider network R9 and R11. Thus the amplifier output is symmetrical about a zero reference. When the amplifier output goes below zero, emitter follower Q5 conducts to produce the ramp output. When the amplifier output goes above the zero reference, emitter follower Q4 conducts to produce the ramp output.

4-100. The duration of the ramp output is controlled by integrating capacitor C6 in the feedback path to the inverting input. This capacitor is either allowed to charge through the operational amplifier, producing a ramp, or discharged by FET switch Q3. FET switch Q3 is controlled by the reset input pulse through switch Q1 and level converter Q2. When the reset input goes positive Q3 is turned off removing the short across C6 in the feedback path and the ramp output is generated. The duration of the Y-axis ramp waveform, controlled by C12, is much greater than that of the X-axis.

4-101. CAMERA YOKE DRIVER.

4-102. The camera yoke driver (SM-117) and monitor deflection amplifier circuits are very similar and function identically. Refer to the Monitor Deflection Amplifier theory for circuit operation. There are two camera yoke drivers per camera, one for each axis.

4-103. Resistor R6 functions as the yoke series resistor for voltage comparison. On one of the yoke drivers, R46, R47 and R48 are used for skew correction by means of one axis input applied to pin H and the other axis to pin D. R3 and C3 form a fixed linearity network.

4-104. FOCUS COIL CURRENT REGULATOR. The camera focus coil current regulator is identical to the regulator in the monitor. Refer to the monitor focus coil current regulator for its operation.

4-105. HIGH VOLTAGE POWER SUPPLY. The high voltage power supply circuit (SM-121) is a dc to dc converter with regulated outputs of −100 volts, +300 volts, and +900 volts. The power supply consists of a regulator, oscillator, high voltage transformer, voltage tripler, and rectifier/filter networks. The +36 volt and −15 volt inputs are provided by the power supply in the Monitor Table.

4-106. Regulation of the high voltage power supply is accomplished by sensing the +300 volt output. The regulator consists of source follower Q1, emitter follower Q2, and amplifier Q3 and Q4. An over-voltage or under-voltage condition at the +300 volt output is applied to the gate of Q1. This voltage change is coupled through Q2 to amplifier Q3 and Q4. The output of the amplifier, applied to the emitters of oscillator transistors Q5 and Q6, controls the magnitude of oscillator drive in the primary of T1. When an over-voltage condition exists on the +300 volt output, the driving voltage in the primary of T1 is decreased and therefore decreases the secondary voltage. Likewise, when an under-voltage condition is sensed at the gate of Q1, the driving voltage in the primary will increase which will increase the secondary voltage. The +300 volt output is adjusted by high voltage adjustment R1. The +900 volt output is derived from the +300 volt output by a voltage tripler consisting of D2, C17, D3 and C21 and rectified by D4. The −100 volt output is provided by a transformer secondary tap, rectified by D1, and filtered by C14, C15, and C16.

4-107. MONITOR TABLE.

4-108. The printed circuit boards used in the Monitor Table are described below.

4-109. INTENSITY COMPENSATOR. The Intensity Compensator chassis consists of three cards, a multiplier-adder card (SM-118), a multiplier card (SM-128), and an adder-rooter card (SM-120). Operation of each card is described below.

4-110. The multiplier-adder card receives the X-size (X_S) and Y-size (Y_S) signals and generates an output whose function is $0.1/X_SY/+ 0.01/X_S/+ 0.01/Y_S/$. The X_S and Y_S inputs to the card are applied respectively to IC3 and IC1 which are absolute value circuits. A portion of the output of each amplifier is taken across R11 and R20 and applied to the input of output amplifier IC6 to give the $0.01/X_S/$ and $0.01/Y_S/$ terms. The outputs of IC1 and IC3 are applied to IC2 and IC4 which generate logarithmic functions of their inputs. The log signals are then added by IC5. The sum of two log functions is always the same as the log of the product of the functions. Therefore D10 at the input of IC6 is used to generate the anti-log of the log product, which gives the $0.1/X_SY_S/$ term at the output. The product $(0.1/X_SY_S/)$ may be adjusted by GAIN pot R9.

4-111. The multiplier card is a two channel card, one channel receives a differentiated horizontal animation signal $dX_A,/dt$ the other channel receives the differentiated vertical animation signal dY_A/dt. Each channel multiplies its input by itself to produce squared outputs $(dX_A/dt)^2$ and $(dY_A/dt)^2$. The two channels are of similar operation so only one will be described. The differentiated input is applied to both inputs of multiplier IC1. The differential offset of one input is balanced by the INPUT BAL control R3. Gain of the multiplier is adjusted by the GAIN FACTOR ADJ pot R14. The multiplier output is amplified by IC2 with the amplifier offset controlled by OUTPUT LEVEL pot R4.

4-112. The adder-rooter card differentiates the horizontal and vertical animation signals and takes the square root of all the terms in the various inputs to the intensity compensator. Differentiation of the animation signals is accomplished with an RC operational amplifier circuit composed of, respectively, R25, C4, IC4 and R23, C5, IC5. The amplifier outputs are available at the respective test points. The squared differentiated animation signals are applied to the two inputs of IC6. The summed animation signals are summed with the size signal from the multiplier-adder card (see above) at the input of amplifier IC1.

4-113. The succeeding circuits take the square root of the inputs to IC1 in order to compensate for the fact that the brightness of the CRT increases roughly with the square of the signal voltage applied to the control grid. The square root is obtained by using the relationship: $1/2 \log X = \log \sqrt{X}$. First, the log of the inputs to IC1 is obtained by means of the non-linear feedback of D2. Then IC2 gives a gain of 1/2 which results in the log of the square root being applied to the input of IC3 through D5. This generates the anti-log and gives the desired square root at the output of IC3.

4-114. INPUT OFFSET potentiometer R6 compensates for the differential offset of the input to IC1. The INTENSITY CONTROL input from SCANIMATE into IC2 varies the overall gain of the square root circuit. The intensity compensation output goes to the monitor video amplifier where it is used to control the gain of the video in order to maintain a constant brightness of the CRT, regardless of the raster size and animation distortions created by SCANIMATE.

4-115. DEFLECTION AMPLIFIER.

4-116. The monitor deflection amplifier (SM-122) converts an input voltage to a current in the deflection yoke. Voltage applied to the deflection yoke and therefore current in the yoke is controlled by comparing the input voltage with the voltage across a resistor in series with the deflection yoke.

4-117. The voltage input at pin 4 is supplied from the SCANIMATE Console to IC1. This voltage is compared with the voltage across the yoke series resistor R63, applied to pin 2 of IC1. IC1 amplifies the differential input and its positive output is applied to the base of Q1 or its negative output to the base of Q3. OFFSET potentiometer, R65, adjusts the raster vertically or horizontally. LINEARITY potentiometer, R68, paralleled by C14 is a frequency compensation network which improves the deflection linearity. Only half of the remaining circuit will be covered since the other half is identical.

4-118. Differential pair Q1 and Q2, activated by the positive output of IC1, drives constant current driver Q5. Diode D6 maintains a constant 36 volts at the base of Q5 and D5 is a protection diode. The signal from Q5 collector is applied to the base of Q9 and Q12. When driving transistor Q9 and Q12 are turned on, control of the power transistors is evenly distributed between Q7 through Q12. Driving transistors Q7 through Q12 turn on power transistors Q13 through Q18 which supply the current to the deflection yoke through resistors R58 and R60. Deflection yoke current supplied by power transistors Q13 through Q18 is shared equally by the parallel/series circuit configuration.

4-119. MONITOR VIDEO AMPLIFIER. The monitor video amplifier circuit (SM-127) amplifies and modulates the TV Scanner video signal with the intensity compensation signal and supplies a composite video signal to the monitor CRT. The circuit consists of differential amplifier Q1 and Q2, emitter followers Q3 and Q4, multiplier IC1, and output amplifier Q5, Q6, and Q7.

4-120. The video input signal is amplified by amplifier Q1 and Q2 and coupled to the clamp circuit by emitter follower Q3. GAIN adjustment, R7, adjusts the gain of the amplifier state. Diode D3 clamps the video signal, so that the video signal output of emitter follower Q4 is referenced to zero at the input of multiplier IC1. Balance adjustments R28 and R29 shift the input signals so their zero reference coincides for multiplying. The multiplier differential outputs are the product of the video signal and intensity compensation input. These two outputs are amplified and combined in output amplifier Q5, Q6, and Q7. The composite video signal is then applied to grid # 1 of the monitor CRT.

4-121. MONITOR BLANKING AMPLIFIER. The monitor blanking amplifier circuit (SM-123) supplies a blanking pulse of approximately 36 volts peak-to-peak to the cathode of the monitor CRT. The circuit consists of differential amplifier Q1 and Q2, amplifier Q3, and emitter follower Q4. The blanking input pulse is amplified and inverted by Q1, Q2, and Q3. The output of Q3 is held at zero reference by diode D1. The +36 volt output pulse is ac coupled and clamped to a variable reference, controlled by the Brightness control, by diode D2 through emitter follower Q4. The dc level of the output pulse is controlled by the Brightness control through Q4.

4-122. FOCUS COIL CURRENT REGULATOR. The focus coil current regulator circuit (SM-119) controls the amount of current through the focus coil of the camera or monitor tube. The circuit consists of amplifier IC1 and series regulator Q1. A constant voltage is maintained across resistor R2. Any change in this voltage is detected and amplified by amplifier IC1. The amplifier controls Q1 which supplies current to the focus coil. Current limiting resistor R1 prevents the amplifier and Q1 from driving excessive current through the focus coil.

4-123. HIGH VOLTAGE POWER SUPPLY.

4-124. ,The monitor high voltage supply circuit (SM-124) is a dc to dc converter with regulated outputs of +100 volts, +1000 volts and 20 kilovolts. The power supply consists of a regulator, oscillator, transformer, voltage sextupler, and a rectifier/filter network.

4-125. Regulation is accomplished by sensing the +1000 volt output at the cathode of D4. The regulator consists of source follower Q1, differential amplifier Q2 and Q3, and inverter driver Q4. A voltage change at the +1000 volt output is coupled through Q1 to Q2. The voltage change is amplified by the differential amplifier and applied through Q4 to oscillator transistors Q5 and Q6 which controls the driving voltage in the primary of T1. The +1000 volt output is adjusted by high voltage adjustment R4. The +100 volt output is derived from the +1000 volt output through R21 and the +100 volt adjust potentiometer R22. The 20 kv output is taken directly from the secondary of T1 and stepped up through sextupler A1.

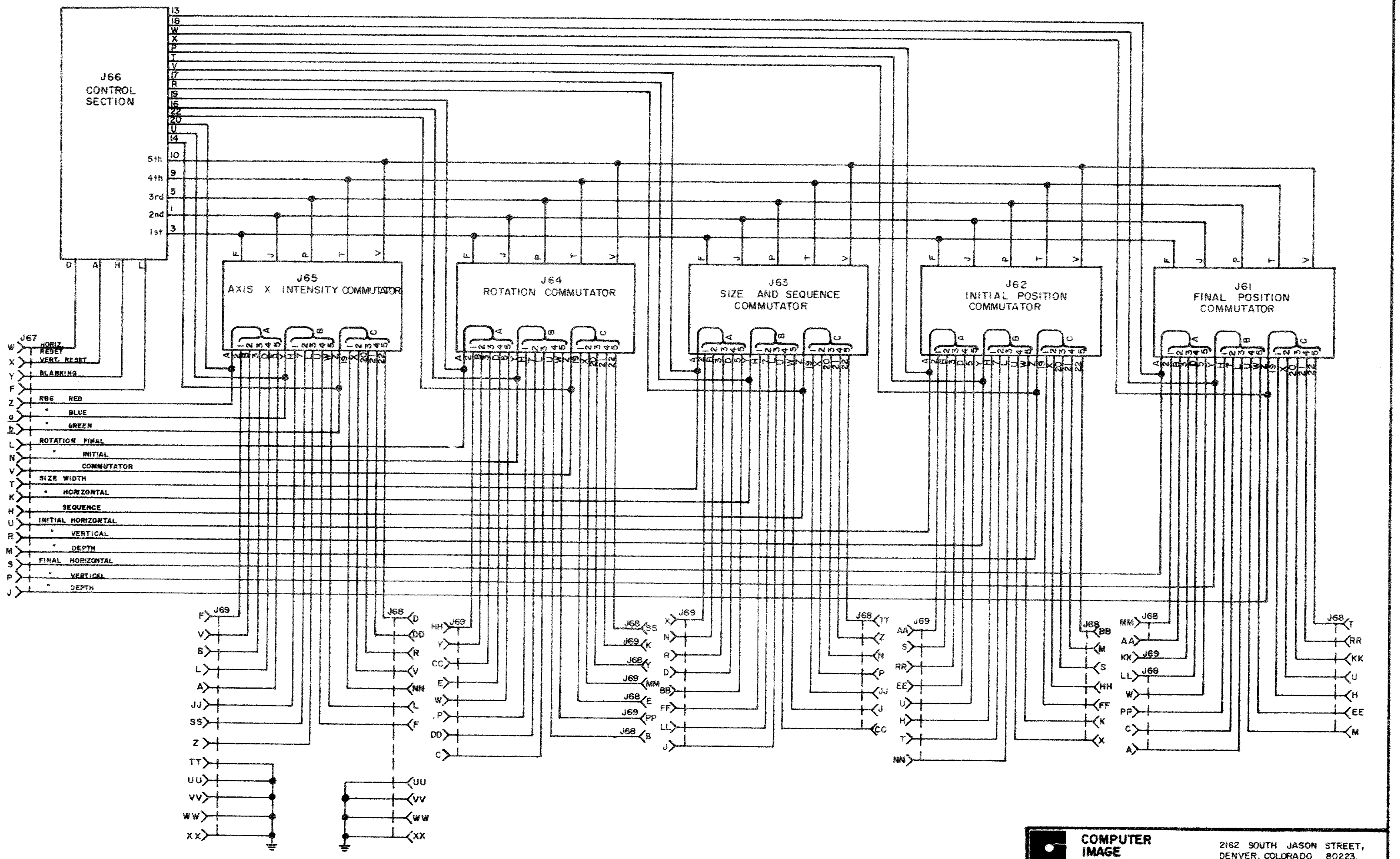
4-126. +5 VOLT REGULATOR.

4-127. The +5 volt regulator (SM-110) consists of sense amplifier IC1, current amplifier Q2, and series pass transistor Q1. The regulator output, adjusted by potentiometer R6, is regulated to ±0.5 volt. IC1 senses a voltage change at R6 and controls current amplifier Q2 accordingly. Q2 drives series pass transistor Q1 to provide the regulated output. The regulation is short circuit protected by a foldback current limiting network.

4-128. The normal current sense voltage between pins 8 and 1 of IC1 is bucked out by voltage divider R2 and R4 which allows the full load current to be delivered to the load. Under short-circuit conditions, the output voltage goes to zero and the bucking voltage is no longer present. Then IC1 limits the output current to approximately 0.5 amps thus greatly reducing the series pass element dissipation.

4-129. ±36-VOLT REGULATOR.

4-130. The plus and minus 36 volt regulators (SM-111) function the same as the +5 volt regulator. Potentiometer R9 adjusts the output voltage. The foldback, current limiting, protection circuit in the –36 volt regulator consists of R10, R11, and Q4. Transistor Q3 prevents erratic operation of the –36 volt regulator if the +36 volt regulator output is shorted.



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CORPORATION

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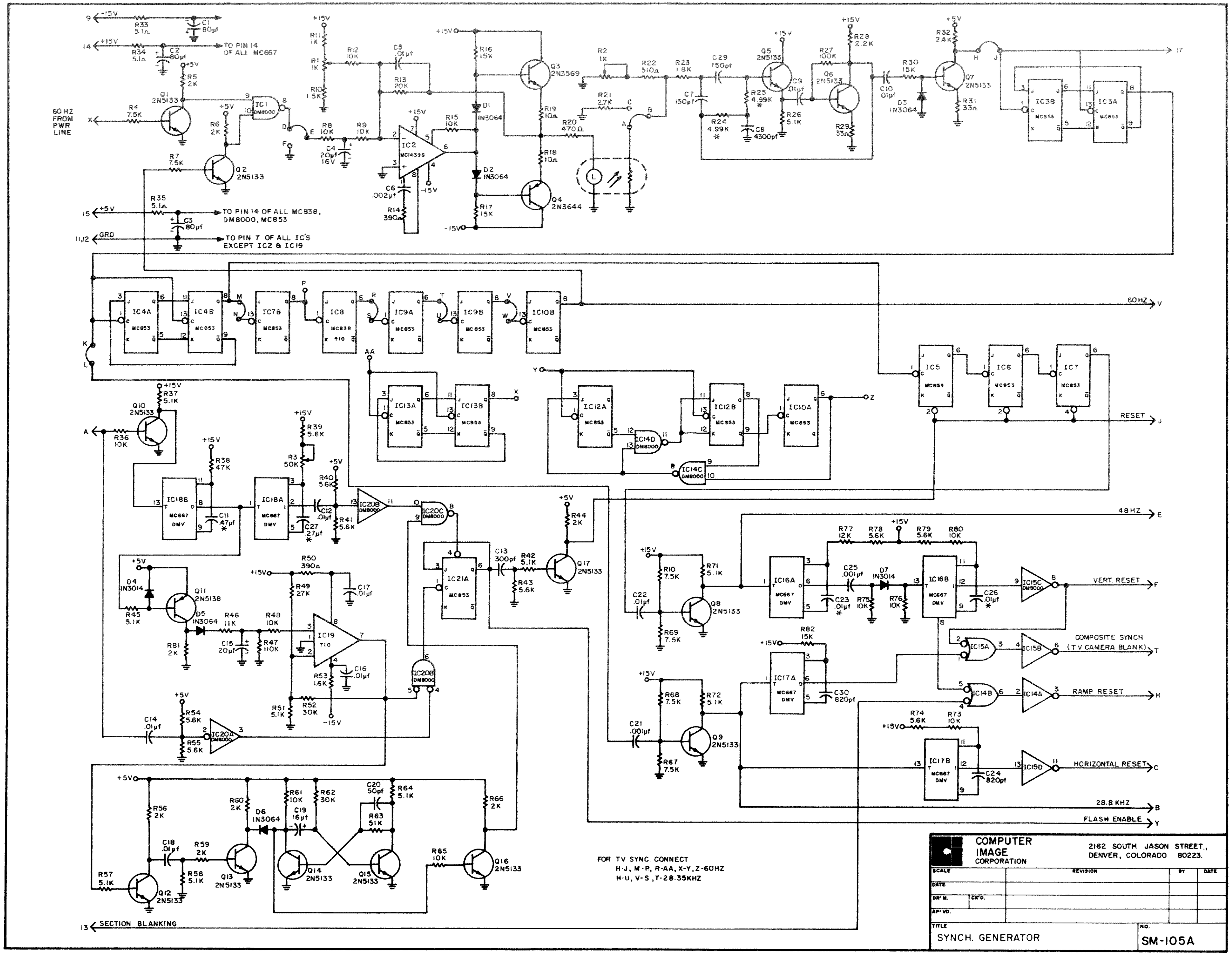
DR'N E.R. CK'D.			
AP'VD.			

TITLE SCANIMATE COMMUTATOR WIRING DIAGRAM

NO. SMW-101



FOR TV SYNC. CONNECT
H-J, M-P, R-AA, X-Y, Z-60HZ
H-U, V-S, T-28.35KHZ

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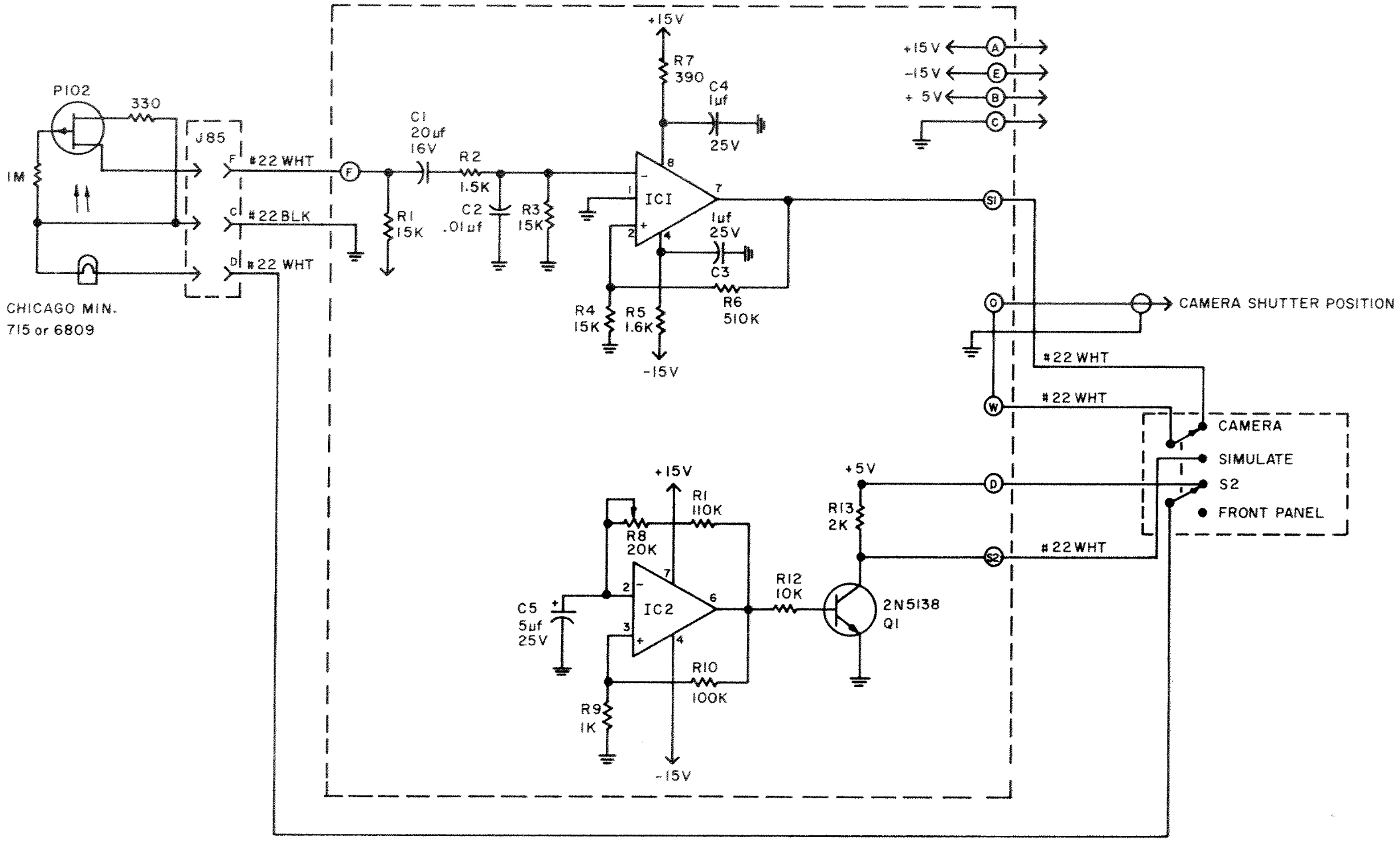
TITLE: SYNCH. GENERATOR

NO. SM-105A



NOTE:
ALL RESISTORS 1/4W UNLESS
OTHERWISE SPECIFIED.

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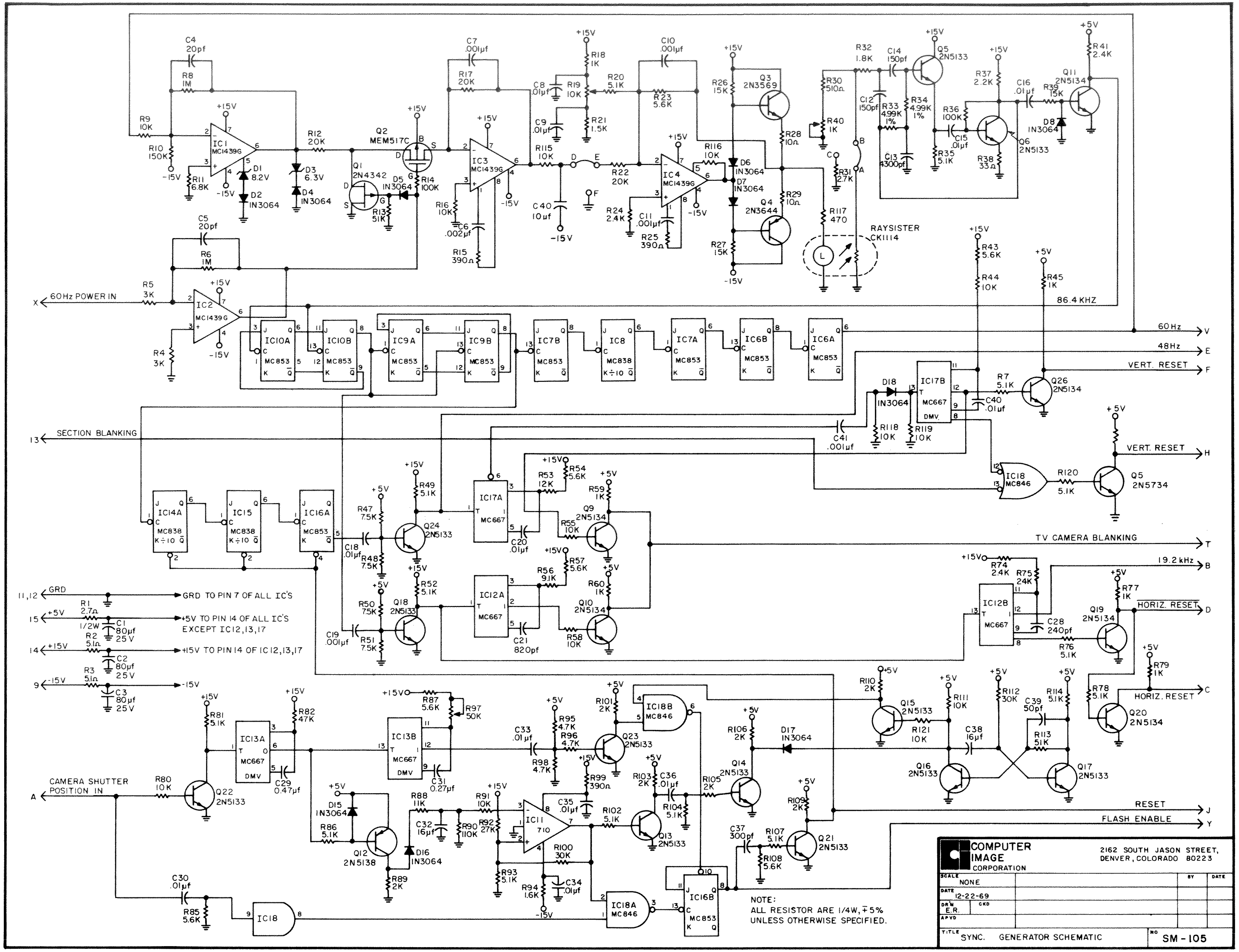
TITLE
SYNCH AND SIMULATOR

NO.
SM-125



NOTE:
ALL RESISTOR ARE 1/4W, ∓5%
UNLESS OTHERWISE SPECIFIED.

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SCALE NONE		BY	DATE
DATE 12-22-69			
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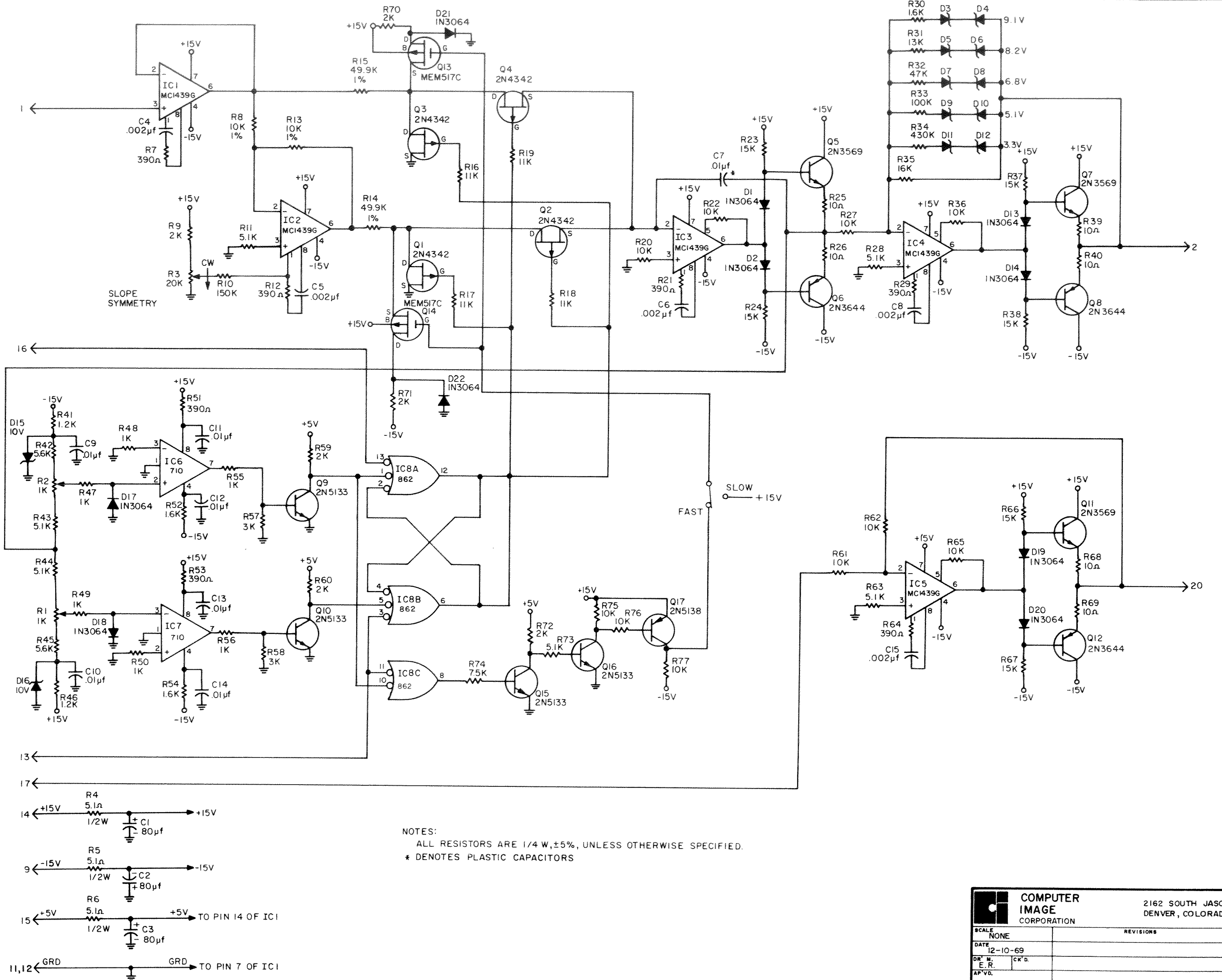
TITLE SYNC. GENERATOR SCHEMATIC		NO SM - 105	



NOTES:

ALL RESISTORS ARE 1/4 W, ±5%, UNLESS OTHERWISE SPECIFIED.

* DENOTES PLASTIC CAPACITORS

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DATE 12-10-69			
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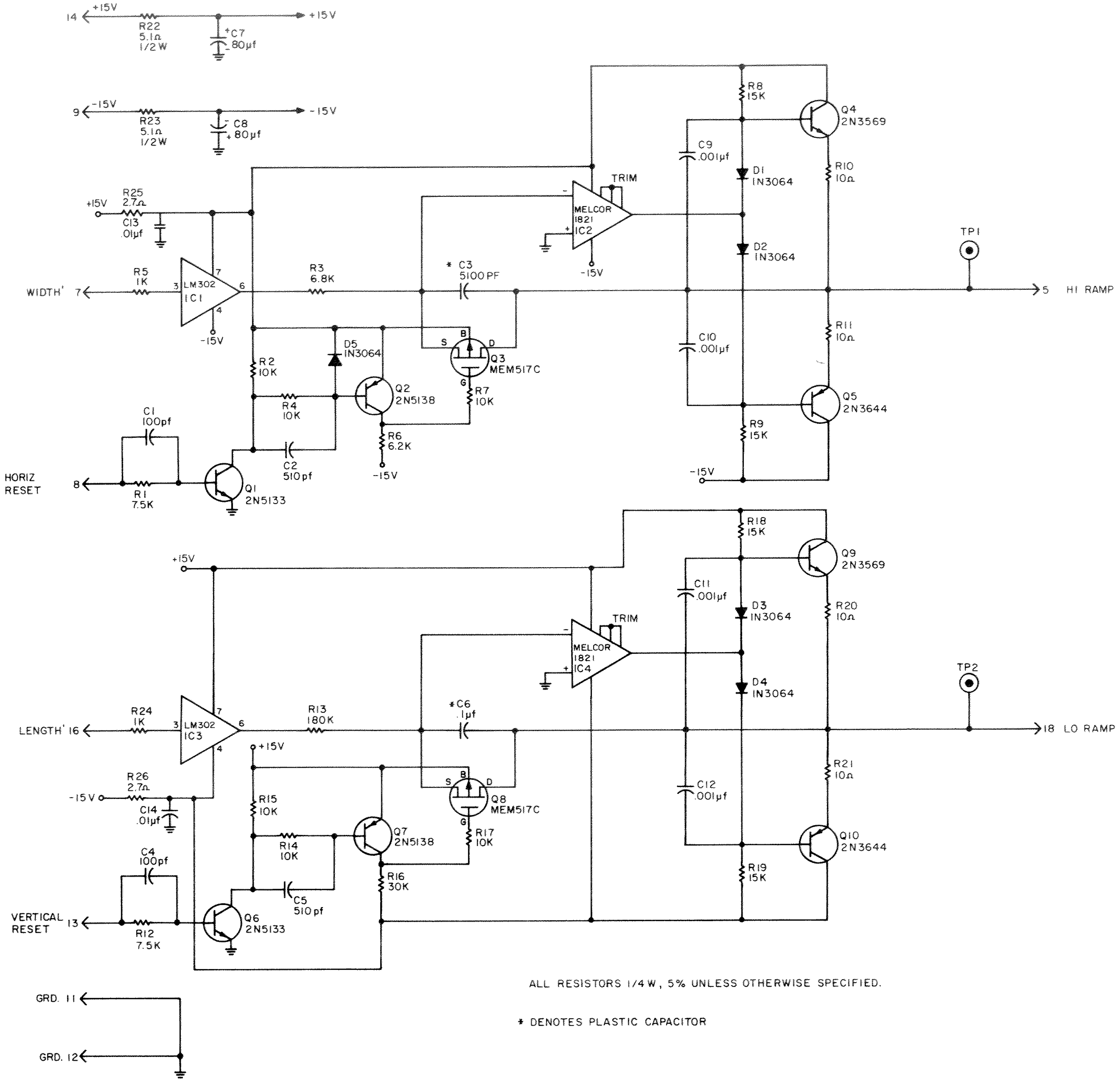
TITLE SCANIMATE ANIMATION OSCILLATOR

NO SM- 107



ALL RESISTORS 1/4 W, 5% UNLESS OTHERWISE SPECIFIED.

* DENOTES PLASTIC CAPACITOR

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SCALE NONE	REVISIONS	BY	DATE
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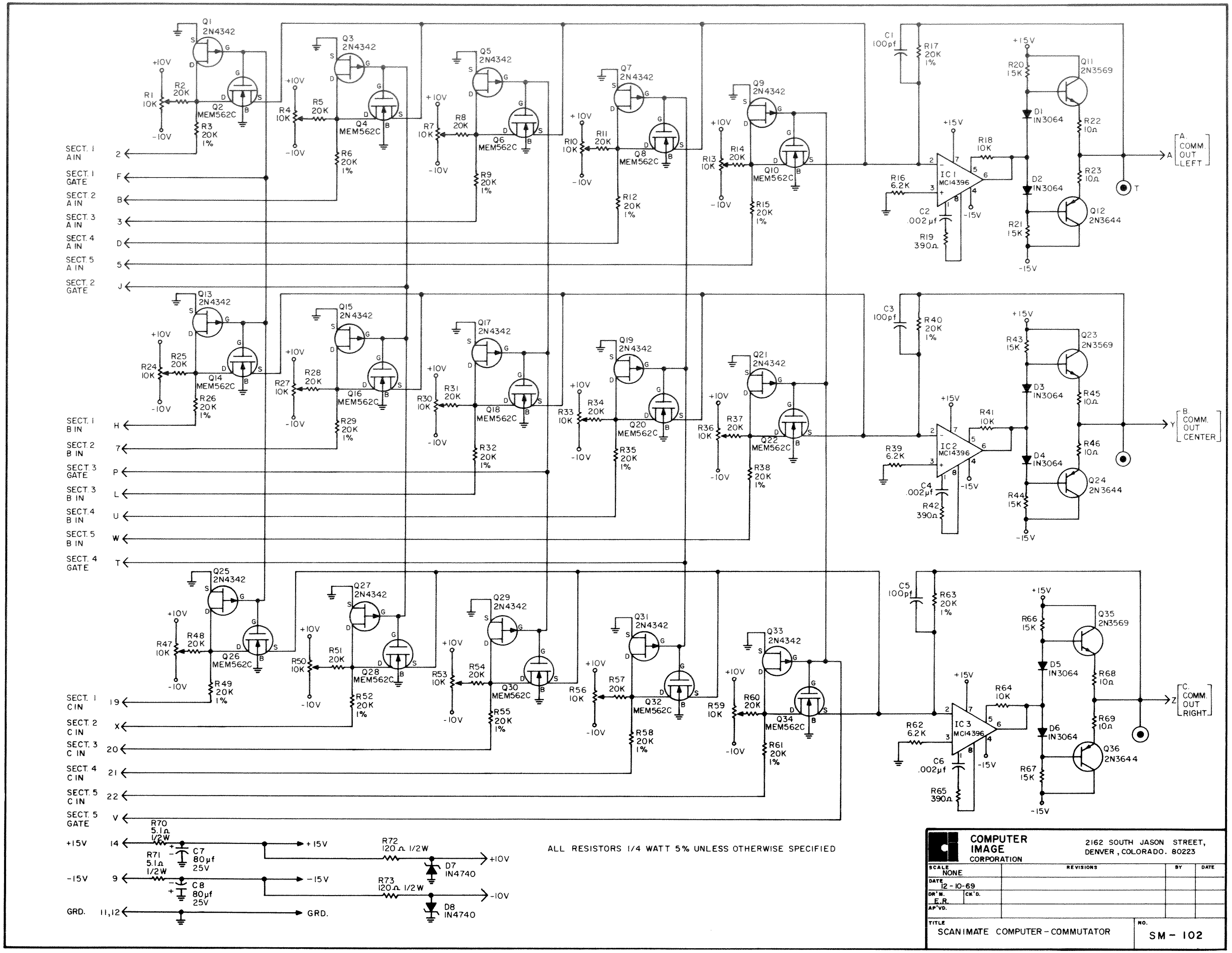
TITLE SCANIMATE RASTER GENERATOR SCHEMATIC

NO. SM-103



ALL RESISTORS 1/4 WATT 5% UNLESS OTHERWISE SPECIFIED

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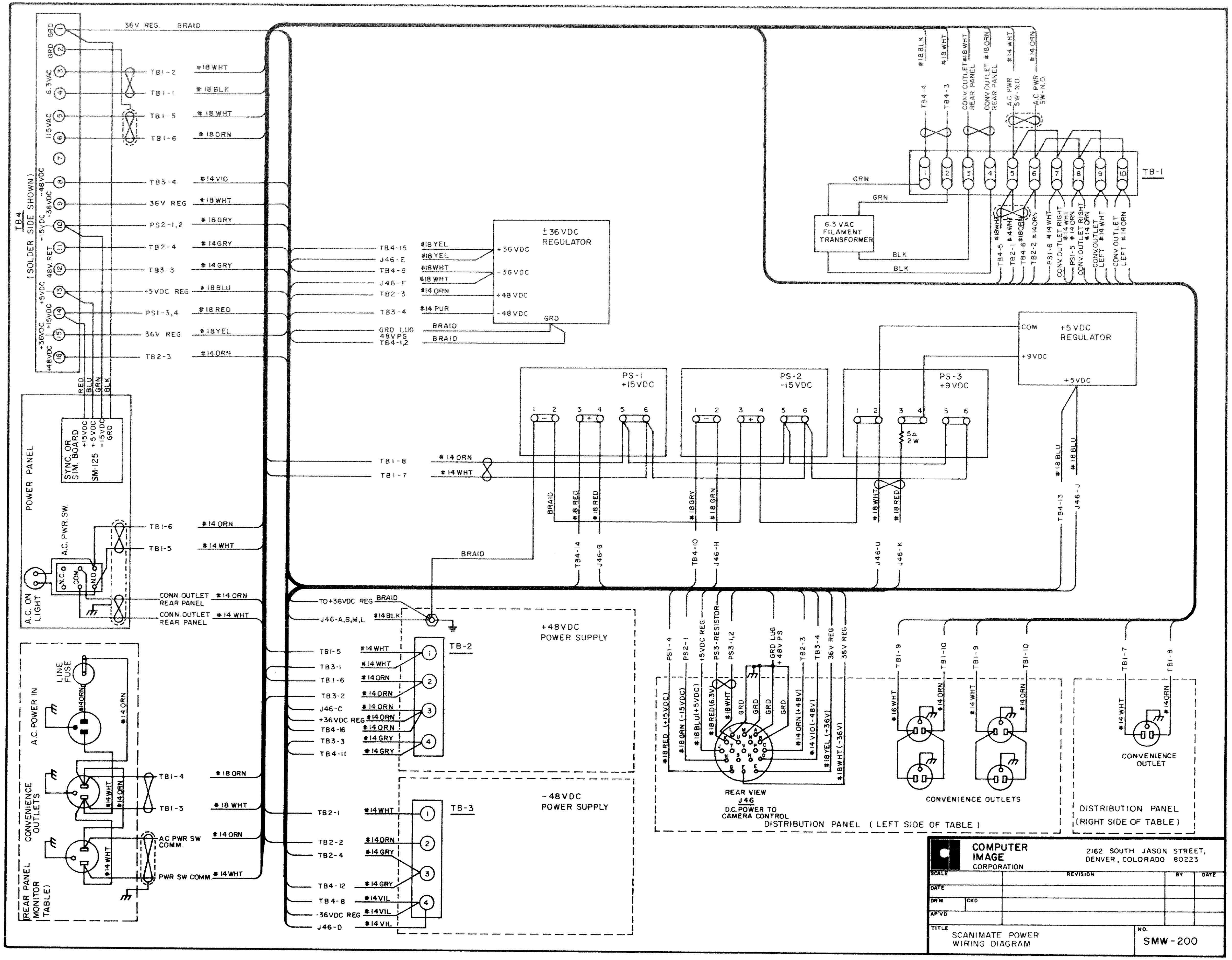
TITLE SCANIMATE COMPUTER-COMMUTATOR

NO. SM-102



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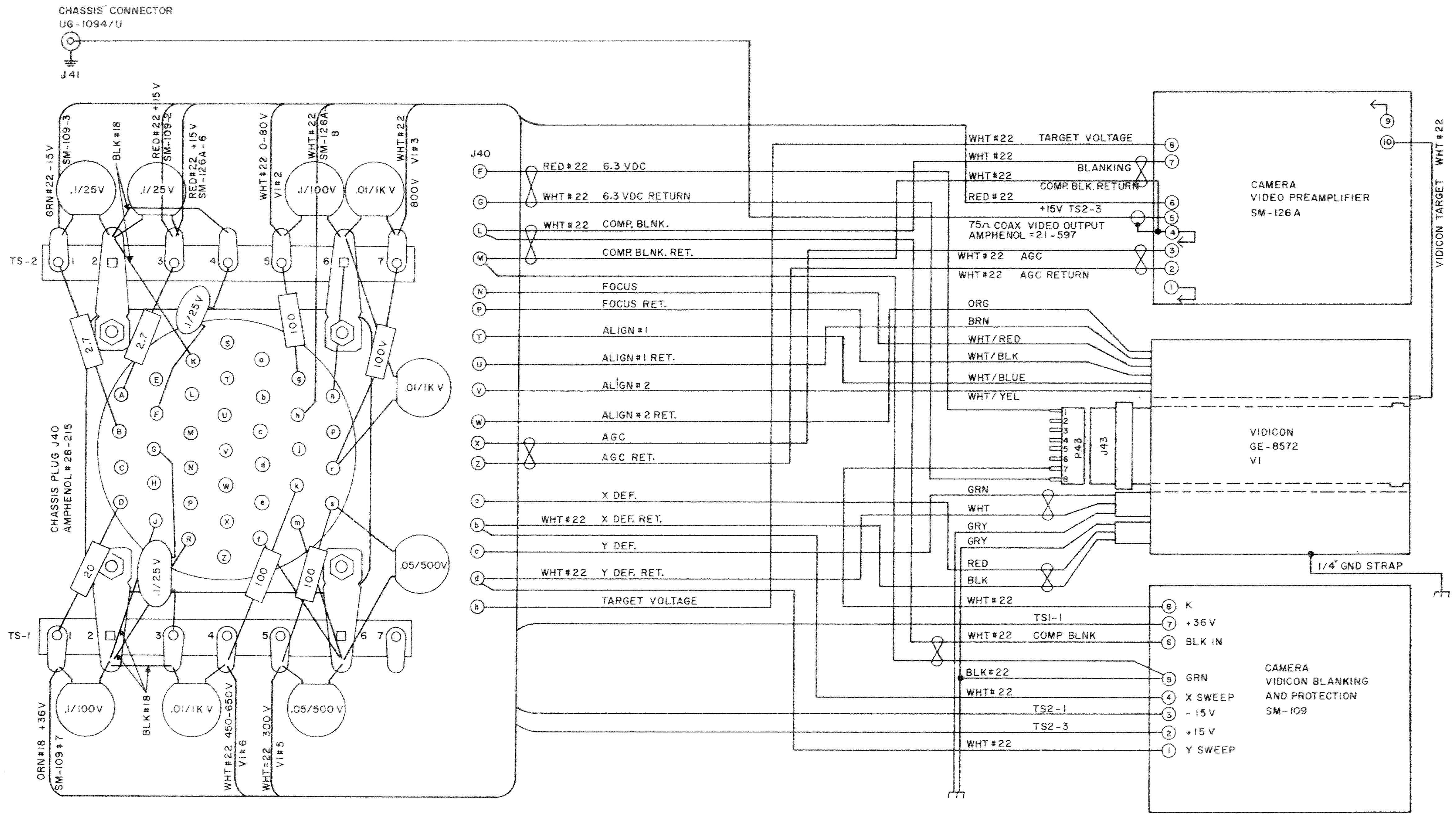
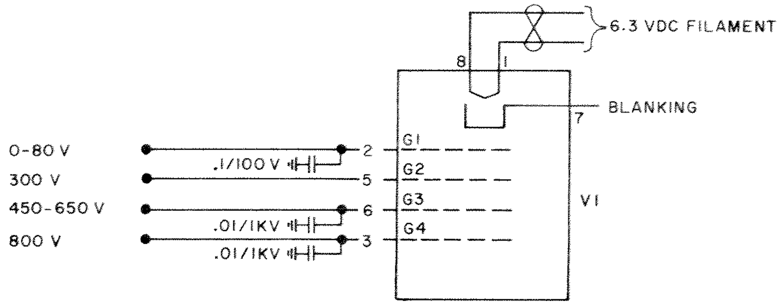
TITLE SCANIMATE POWER WIRING DIAGRAM

NO. SMW-200



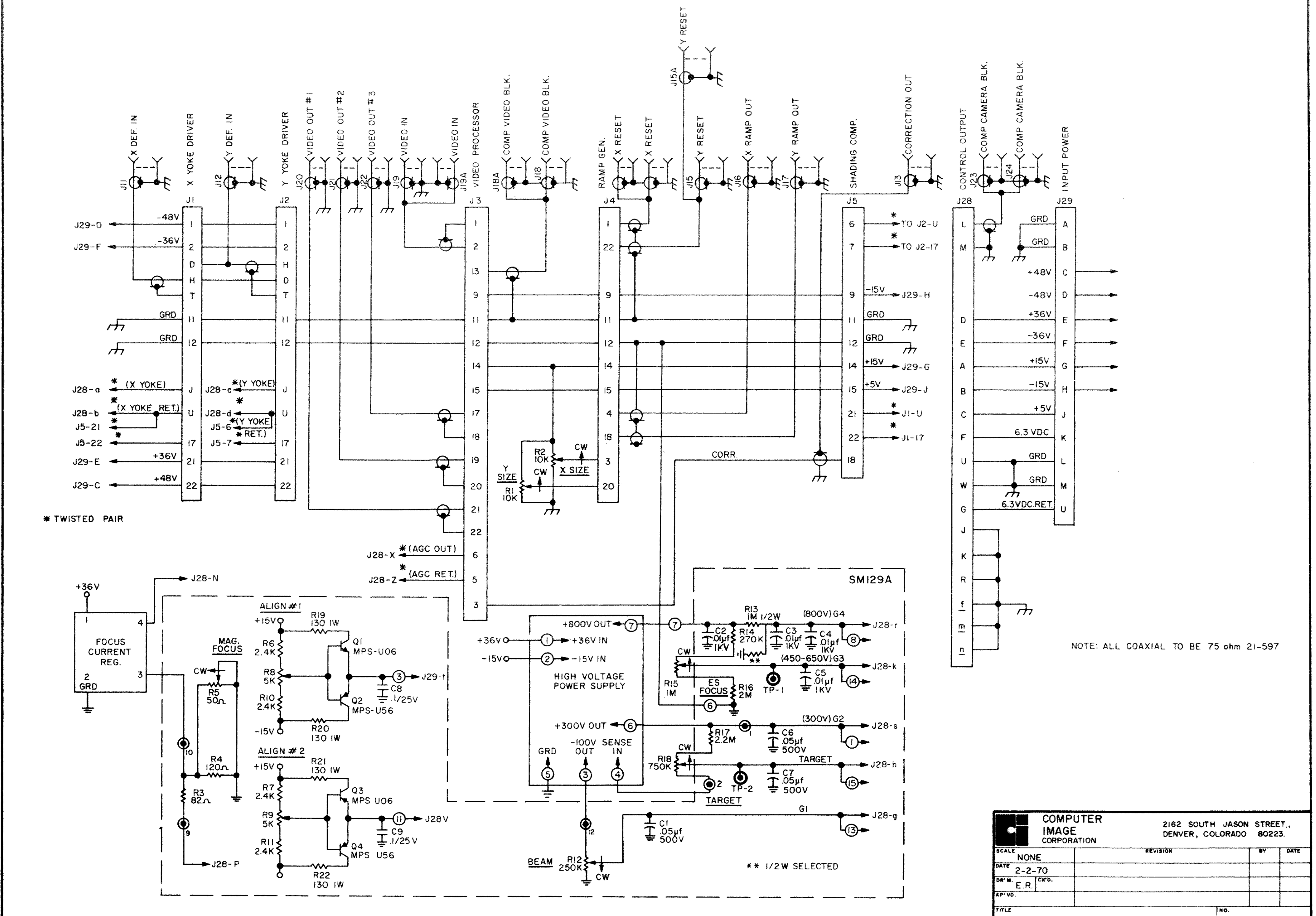


COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET.,
DENVER, COLORADO 80223.

SCALE	REVISION	BY	DATE
DATE			
DR'N. CK'D.			
AP'VD.			

TITLE
CAMERA HEAD WIRING DIAGRAM
NO.



✱ TWISTED PAIR

NOTE: ALL COAXIAL TO BE 75 ohm 21-597

✱✱ 1/2W SELECTED

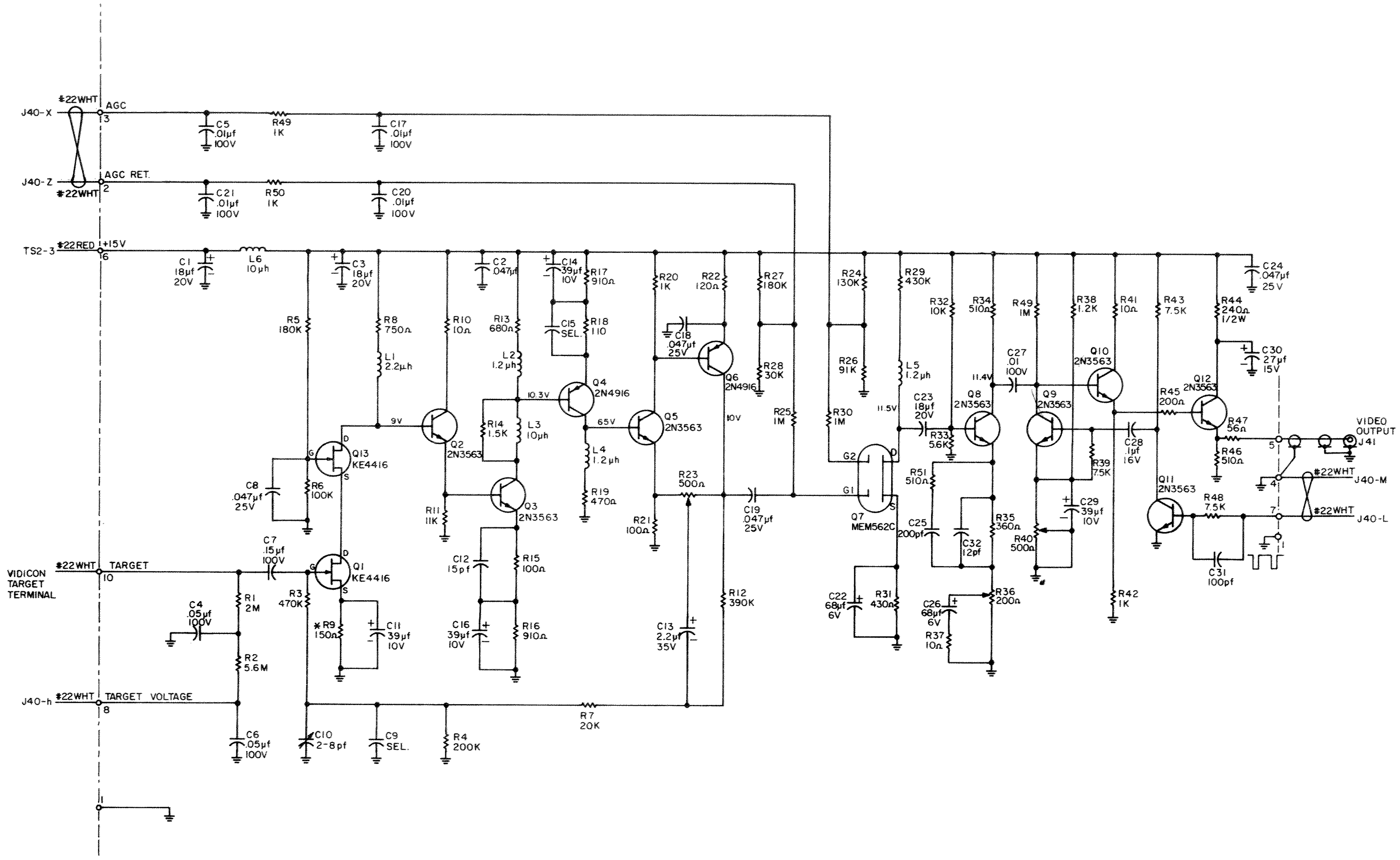
COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET,
DENVER, COLORADO 80223.

SCALE NONE	REVISION	BY	DATE
DATE 2-2-70			
DR'N. E.R. CH'D.			
AP'VD.			

TITLE CAMERA CONTROL WIRING

NO. SMW 300



NOTE

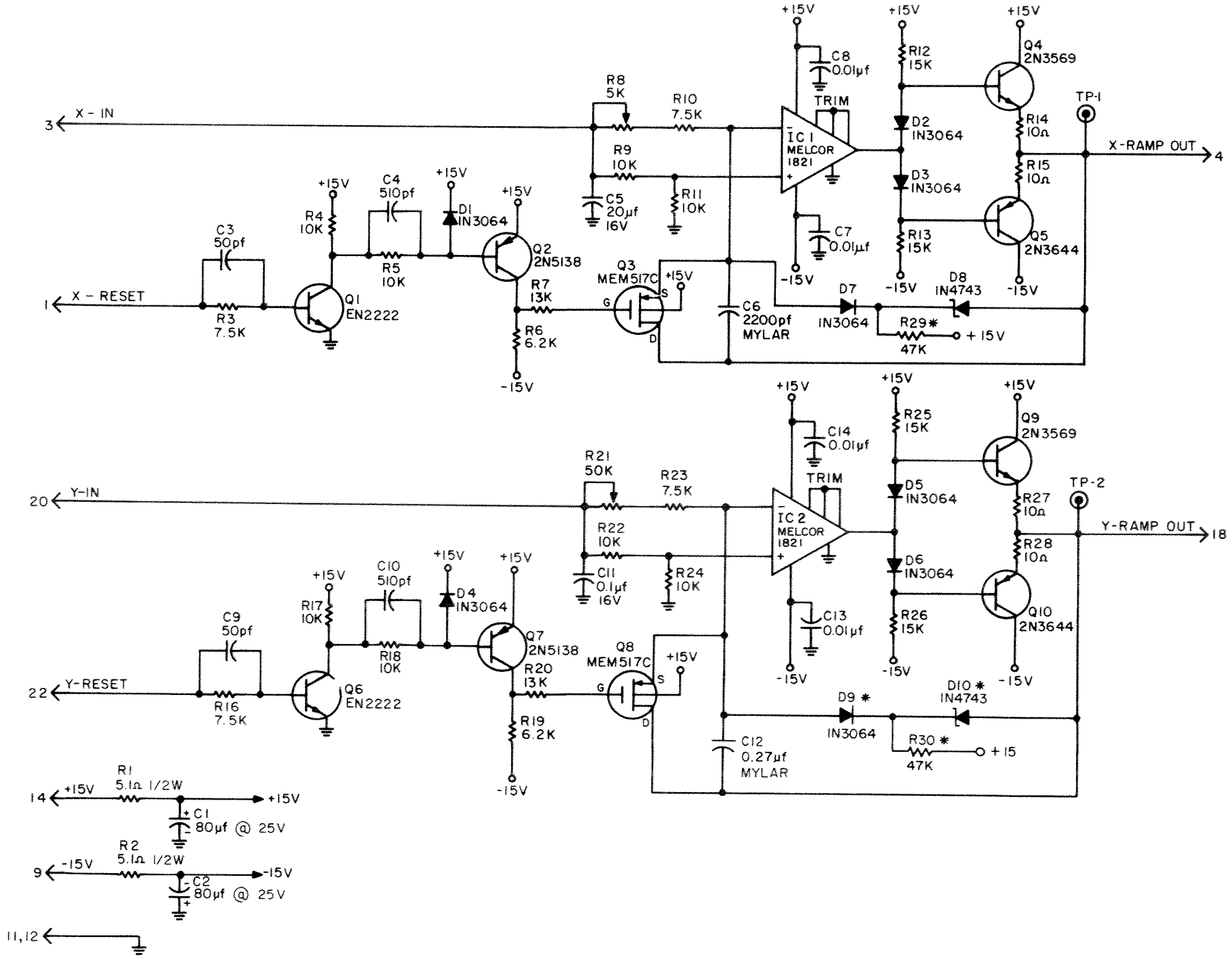
* MAY VARY TO GIVE +9V DRAIN VOLTAGE

ALL RESISTORS 1/4W UNLESS OTHERWISE SPECIFED.

COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET.,
DENVER, COLORADO 80223.

SCALE NONE	REVISION	BY	DATE
DATE 4-16-70			
DR'N. E. R. CK'D.			
AP'VD.			
TITLE CAMERA VIDEO PREAMPLIFIER		NO. SM-126B	



NOTE

ALL RESISTORS 1/4 UNLESS OTHERWISE SPECIFIED

* THESE COMPONENTS ARE OPTIONAL

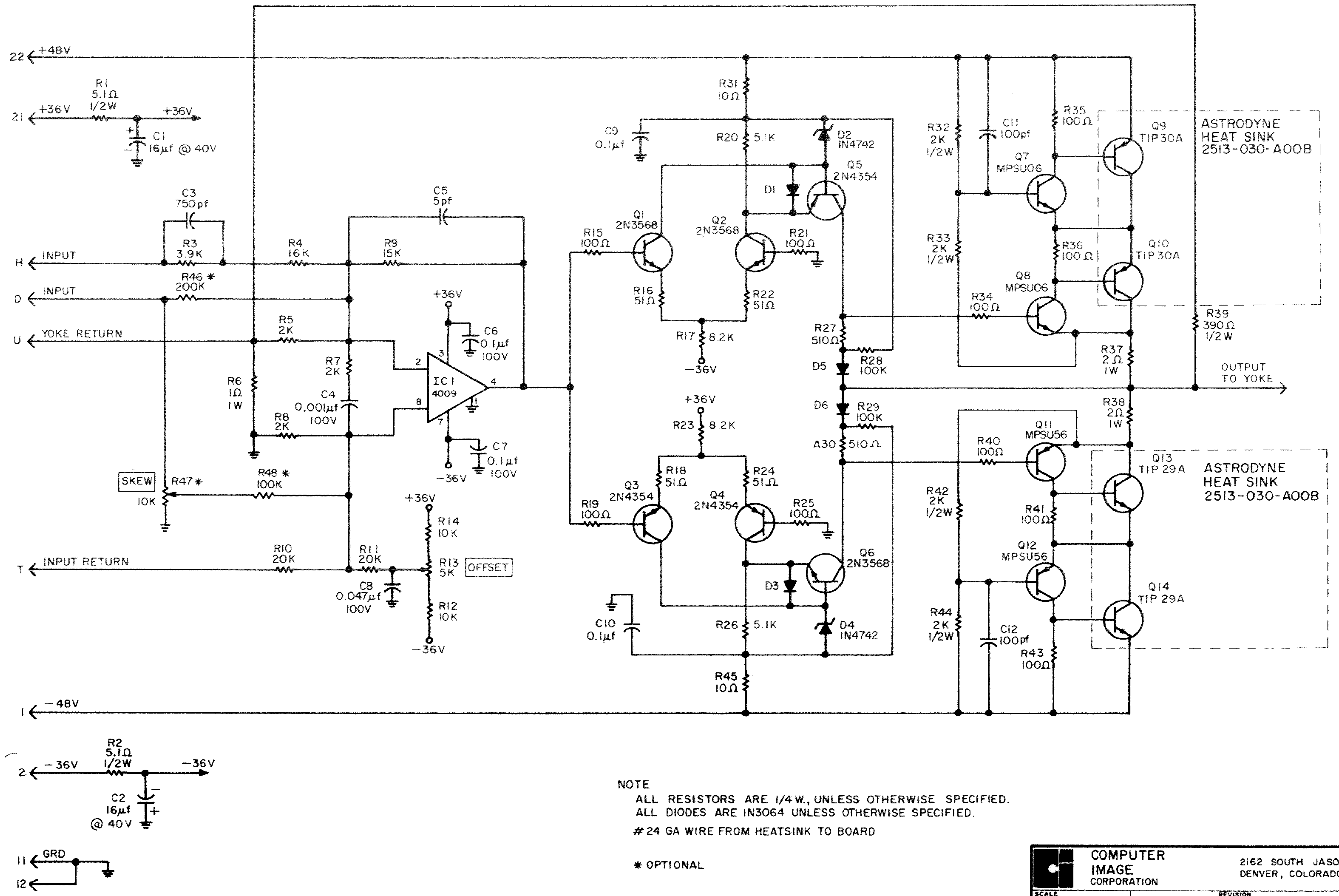
COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET
DENVER, COLORADO 80223

SCALE NONE	REVISIONS	BY	DATE
DATE 2-2-70			
DR'N E.R. CK'D			
AP'VD			

TITLE CAMERA RAMP GENERATOR CAMERA

NO. SM-113A&B



NOTE
ALL RESISTORS ARE 1/4W., UNLESS OTHERWISE SPECIFIED.
ALL DIODES ARE IN3064 UNLESS OTHERWISE SPECIFIED.

24 GA WIRE FROM HEATSINK TO BOARD

* OPTIONAL

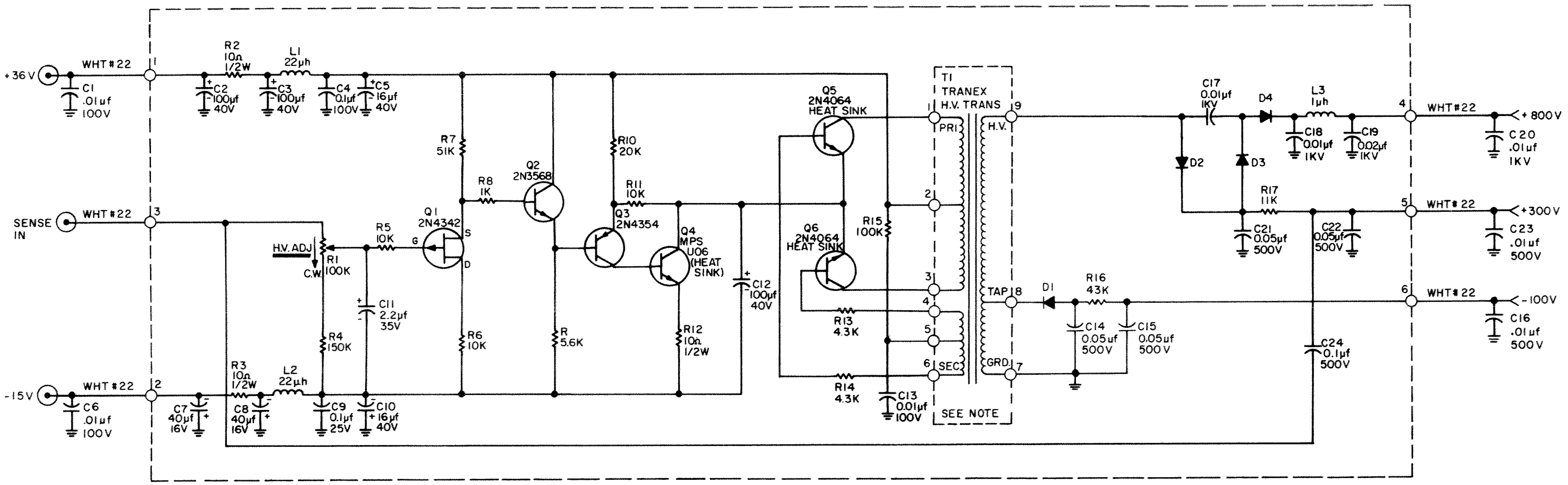
COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET.,
DENVER, COLORADO 80223.

SCALE NONE	REVISION	BY	DATE
DATE 3-31-70			
DR'N E.R. CK'D.			
AP'VD.			

TITLE CAMERA CONTROL CAMERA YOKE DRIVER SCHEMATIC

NO. SM-117B

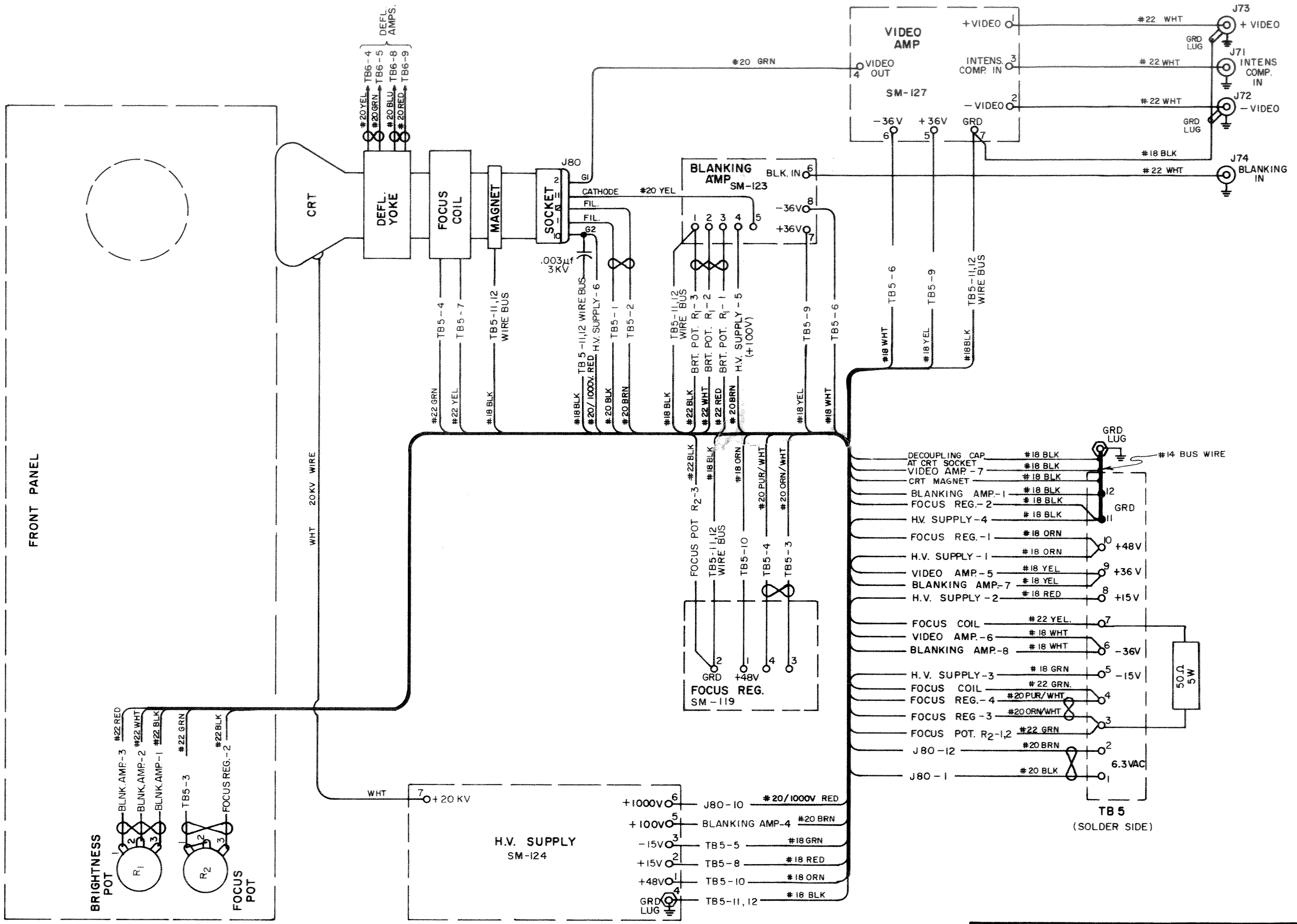


NOTE:
ALL DIODES ARE SFM 30, SEMTECH, UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS 1/4 WATT UNLESS OTHERWISE SPECIFIED.
ALL TRANSFORMER LEADS # 24 WHITE.

COMPUTER IMAGE CORPORATION
2162 SOUTH JASON STREET,
DENVER, COLORADO 80223.

SCALE NONE	REVISION	BY	DATE
DATE 2-2-70			
DR'N. E.R. CK'D.			
AP'VD.			

TITLE
CAMERA HIGH VOLTAGE POWER SUPPLY
NO.
SM - 121



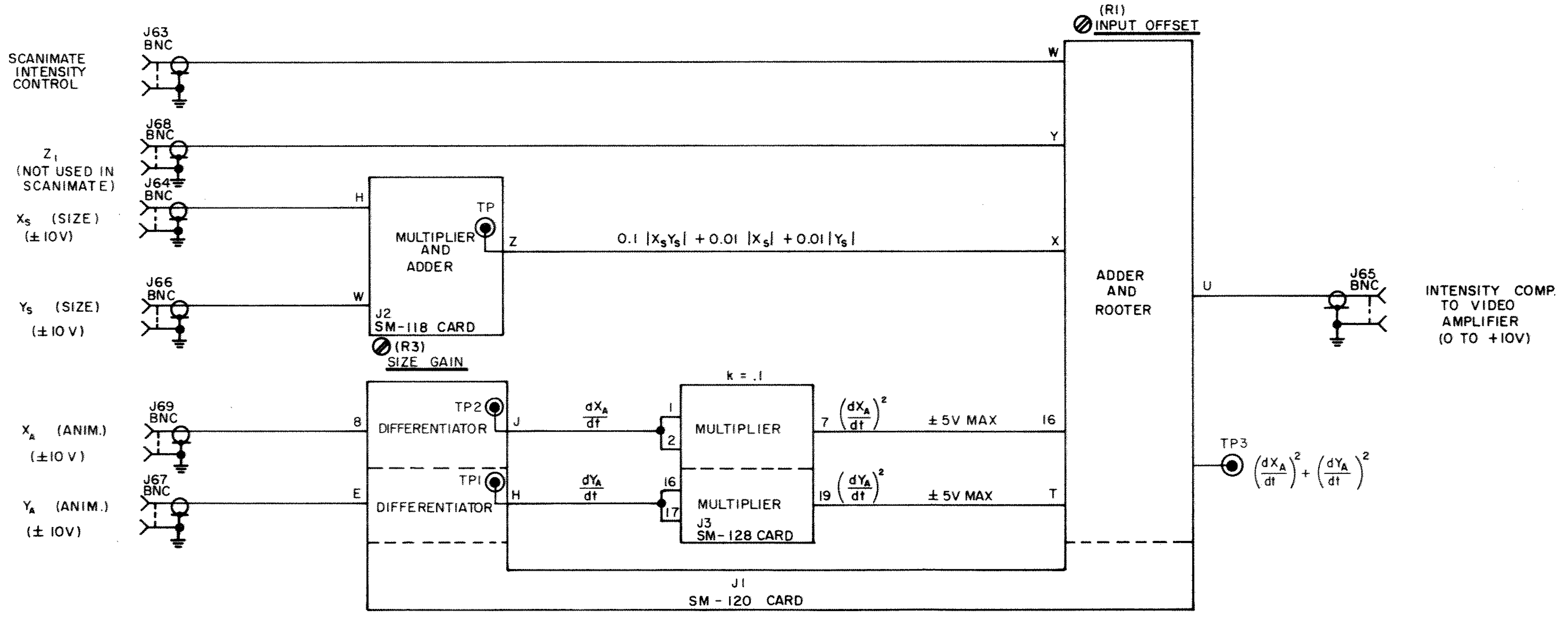
COMPUTER IMAGE CORPORATION

2162 SOUTH JASON STREET,
DENVER, COLORADO 80223

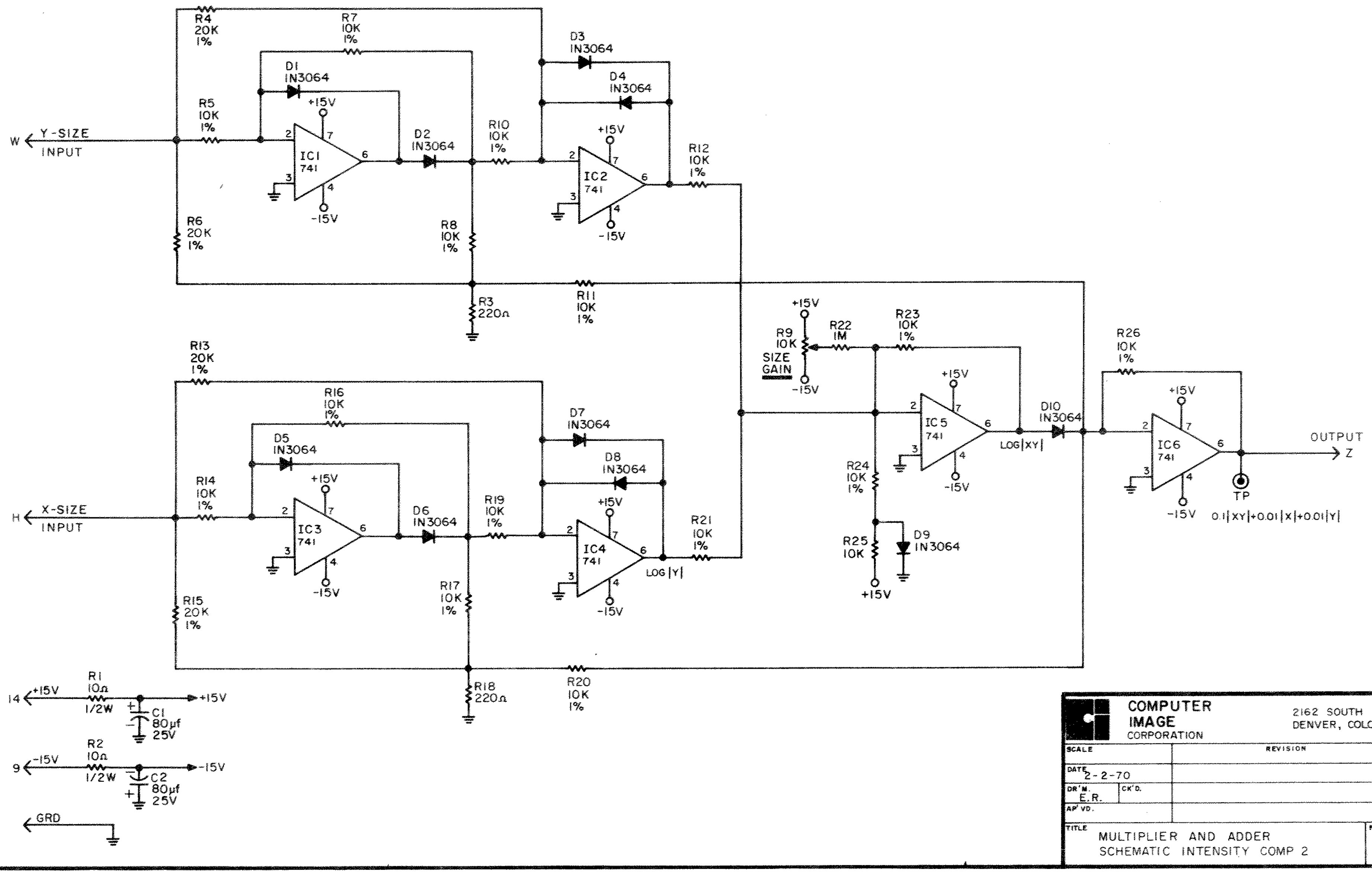
	REVISION	BY	DATE
SCALE: NONE			
DATE: 3-10-70			
DR'N E.R. CK'D			
AP'VD.			

TITLE MONITOR DRAWER WIRING DIAGRAM

NO. SMW-202



COMPUTER IMAGE CORPORATION	2162 SOUTH JASON STREET, DENVER, COLORADO 80223.		
SCALE NONE	REVISION	BY	DATE
DATE 2-2-70			
DR'N. E. R. CK'D.			
AP'VD.			
TITLE INTENSITY COMPENSATOR FUNCTIONAL DIAGRAM	NO.		



COMPUTER IMAGE CORPORATION

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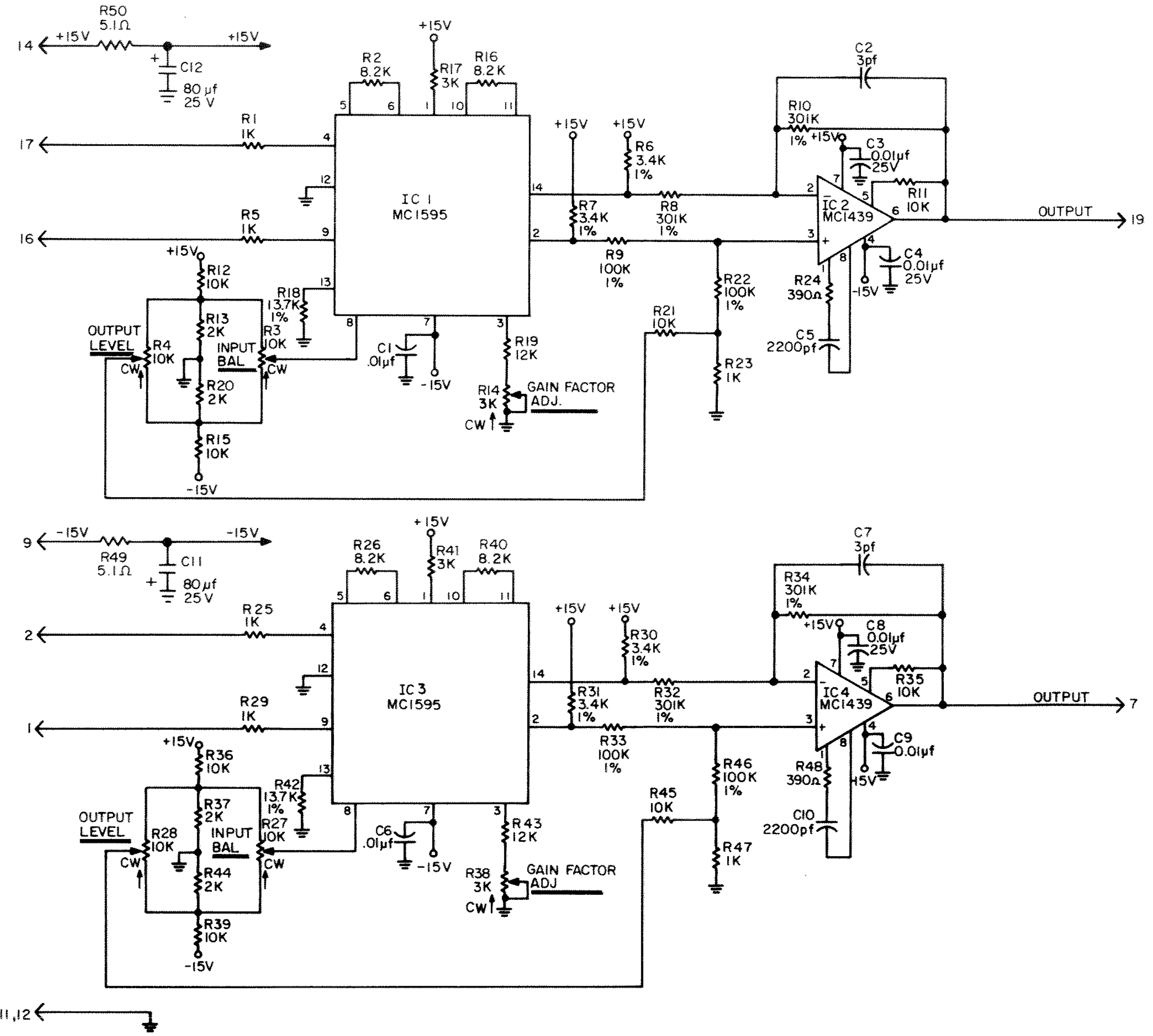
DENVER, COLORADO 80223.

SCALE	REVISION	BY	DATE
DATE 2-2-70			
DR'N. E.R. CK'D.			
AP'VD.			

TITLE
MULTIPLIER AND ADDER
SCHEMATIC INTENSITY COMP 2

NO. SM-118



COMPUTER IMAGE CORPORATION

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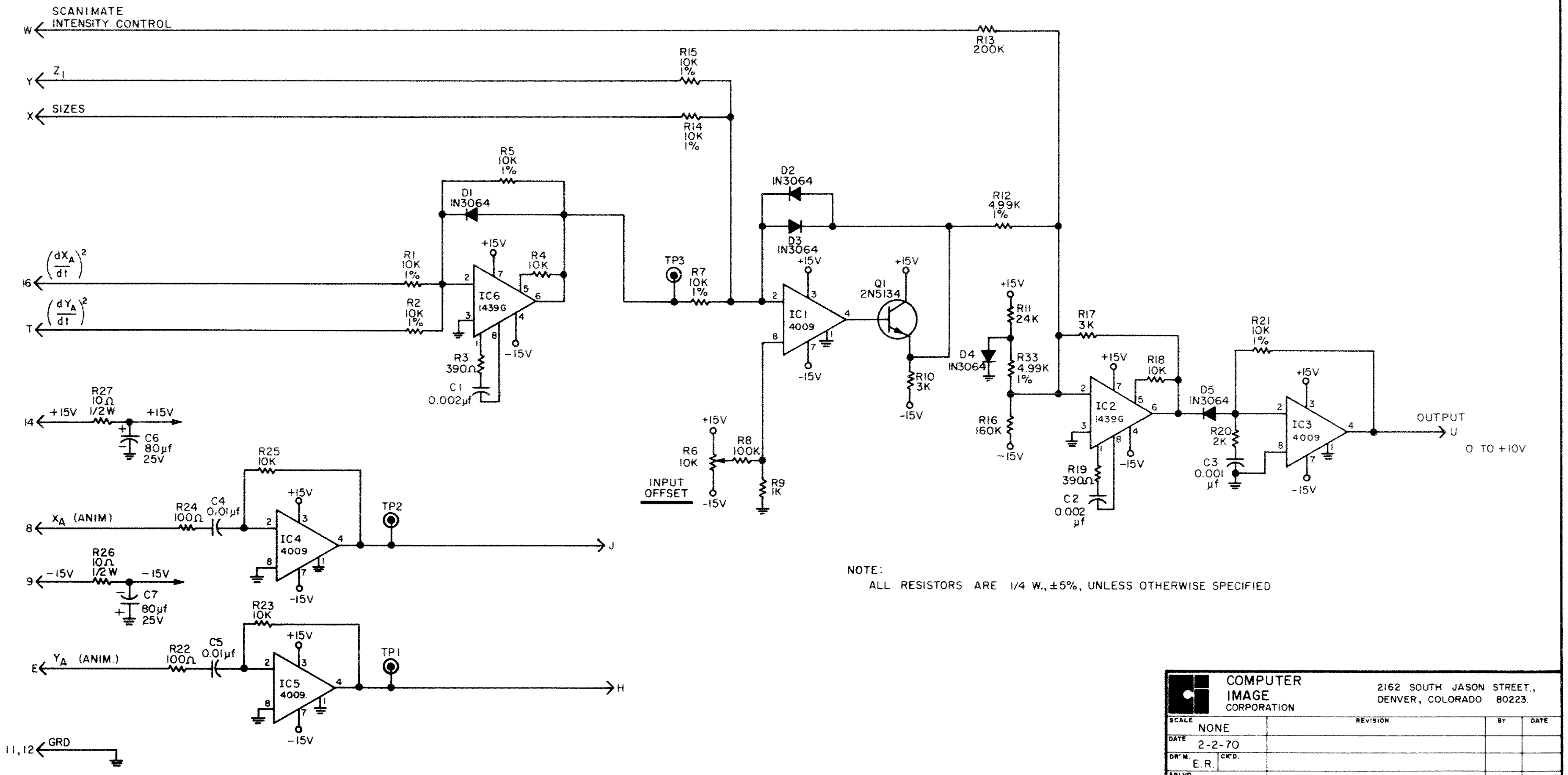
DENVER, COLORADO 80223.

SCALE NONE	REVISION	BY	DATE
DATE 2.-2-70			
DR'N E. R. / CK'D			
APVD.			

TITLE MULTIPLIERS INTENSITY COMP 3

NO. SM - 128



NOTE:
ALL RESISTORS ARE 1/4 W., ±5%, UNLESS OTHERWISE SPECIFIED

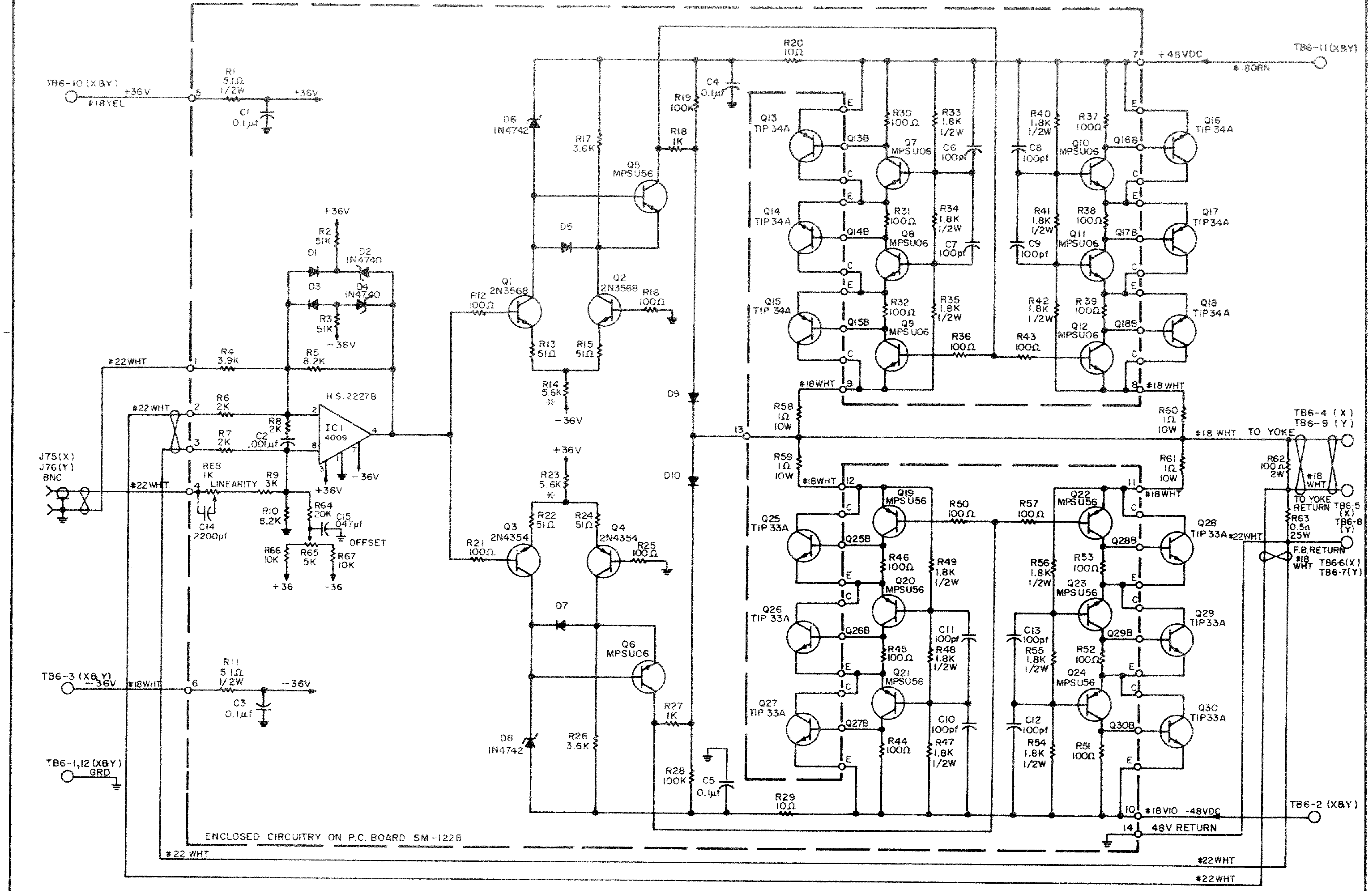
COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET.,
DENVER, COLORADO 80223.

SCALE NONE	REVISION	BY	DATE
DATE 2-2-70			
DR'N. E.R. CK'D.			
AP'VD.			

TITLE
ADDER & ROOTER AND DIFFERENTIATORS
INTENSITY COMP I

NO. SM-120



HEAT SINK
ASTRODYNE - 2404-4

NOTE:
RESISTORS ARE 1/4W., UNLESS OTHERWISE SPECIFIED.
✻ SELECT FOR I_{QUIES} = 0.1 AMP PER OUTPUT BRANCH.
ALL DIODES IN3064 UNLESS OTHERWISE SPECIFIED.
TWO COMPLETE CIRCUITS REQUIRED FOR ONE X AND Y DEFLECTION UNIT.
Q13 THRU Q18 AND Q25 THRU Q30 ARE CONNECTED
TO P.C. BOARD WITH # 22 WHT. WIRE.
Q7 THRU Q12 AND Q19 THRU Q24 ARE HEAT SINK MOUNTED
ON P.C. BOARD WITH I.E.R.C. PA1PB

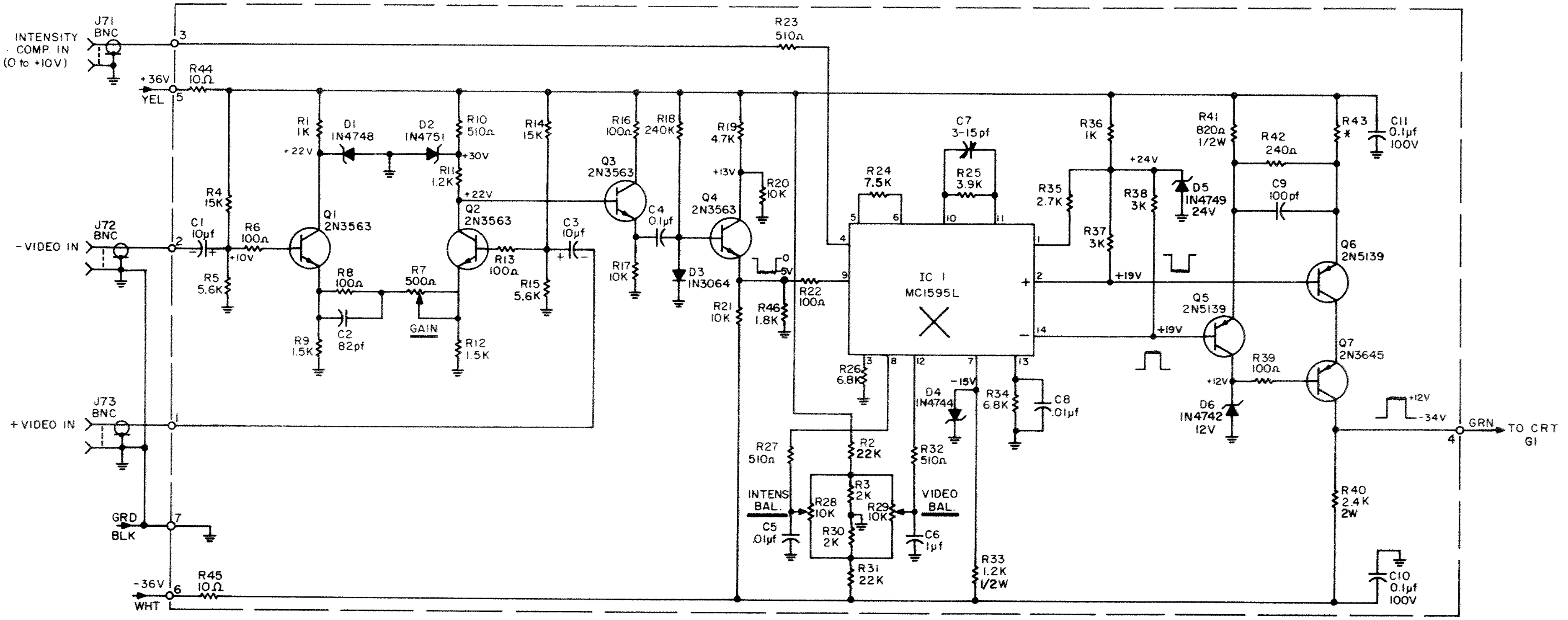
COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET.,
DENVER, COLORADO 80223.

SCALE NONE	REVISION	BY	DATE
DATE 3-20-70			
DR'N. E.R. CK'D.			
AP'VD.			

TITLE
MONITOR X OR Y DEFLECTION AMPLIFIER
SCHEMATIC

NO.
SM - 122B



* THIS RESISTOR TO BE ADDED AS REQUIRED

ALL RESISTORS ARE 1/4W, UNLESS OTHERWISE SPECIFIED

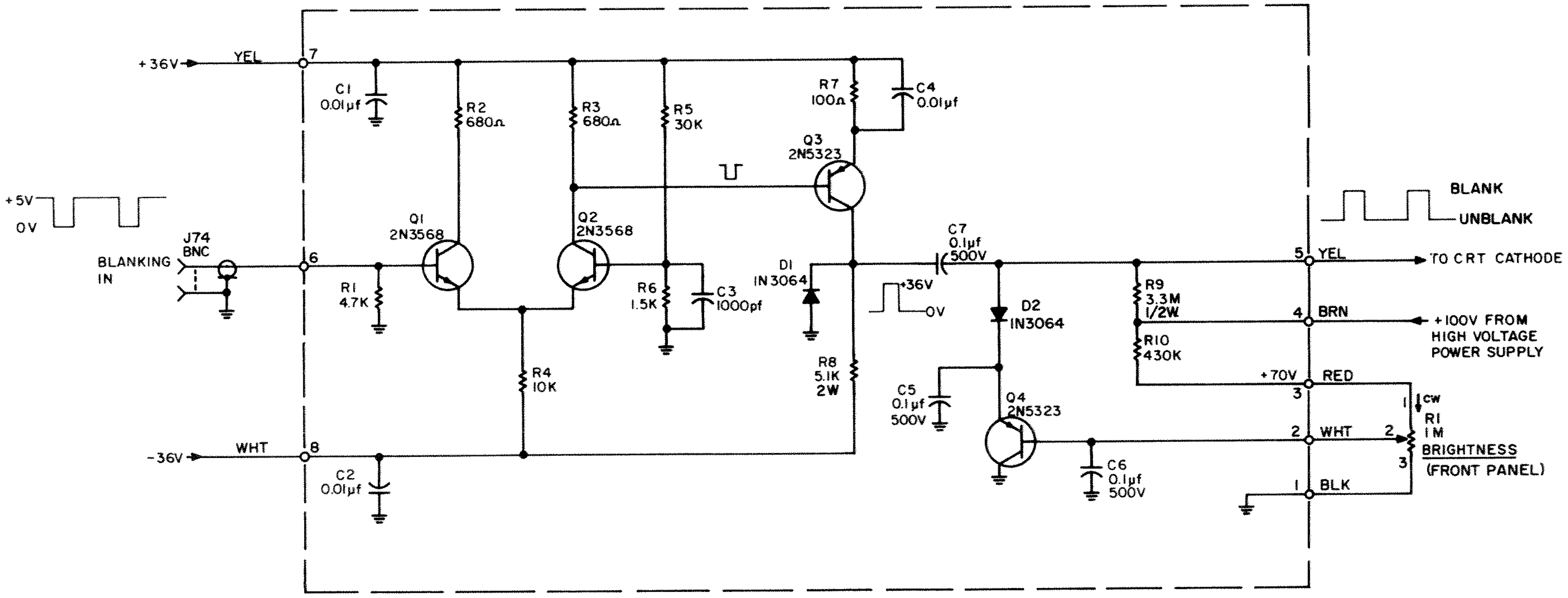
COMPUTER IMAGE CORPORATION

2162 SOUTH JASON STREET,
DENVER, COLORADO 80223

SCALE NONE	REVISIONS	BY	DATE
DATE 2-2-70			
DR'N E.R. CKD.			
APVD			

TITLE MONITOR VIDEO AMPLIFIER SCHEMATIC

NO. SM-127



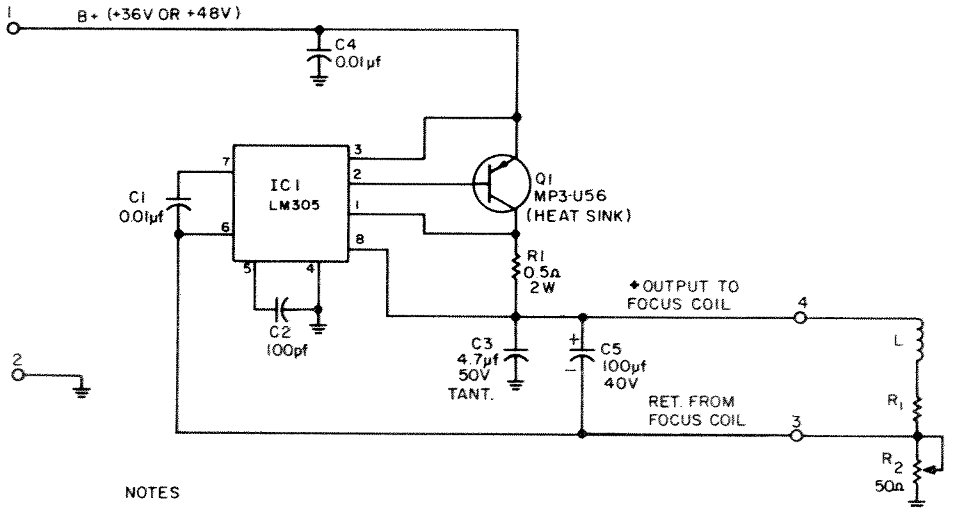
ALL RESISTORS ARE 1/4W, UNLESS OTHERWISE SPECIFIED.

COMPUTER IMAGE CORPORATION
2162 SOUTH JASON STREET,
DENVER, COLORADO 80223

SCALE NONE		REVISION	BY	DATE
DATE 2-2-70				
DR'N. E.R.	CKD.			
AP'VD				

TITLE BLANKING AMPLIFIER SCHEMATIC
5" MONITOR

NO. SM - 123



NOTES

B+ { CAMERA= +36V
MONITOR= +48V

R_1 { CAMERA= 82Ω, 1/2 W
MONITOR= 50Ω, 5W

L { CAMERA= 385Ω ≈ 40mA (+15V)
MONITOR= 180Ω ≈ 200mA (+36V)

COMPUTER IMAGE
CORPORATION

2162 SOUTH JASON STREET,
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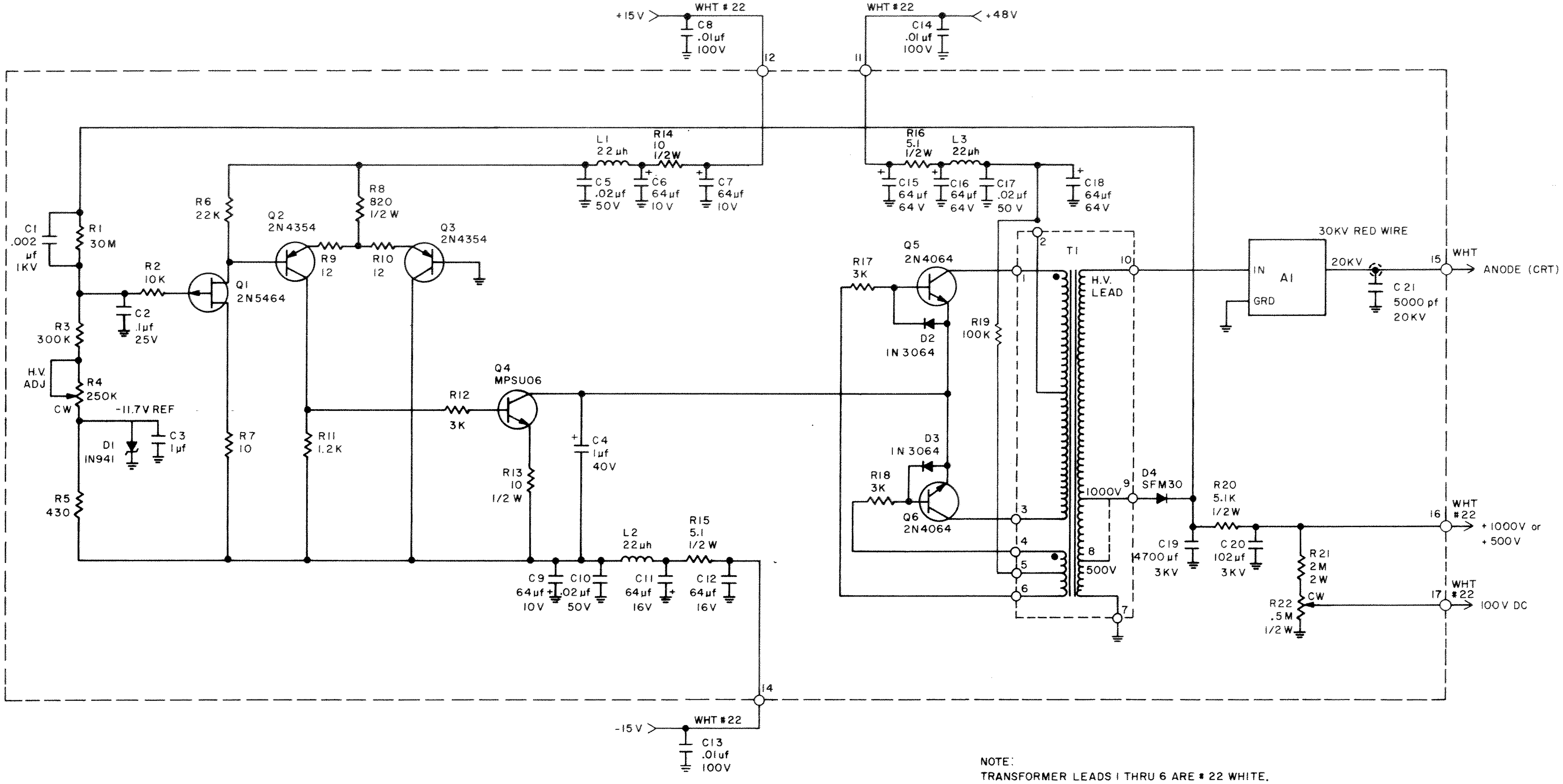
SCALE NONE	REVISION	BY	DATE
DATE 2-2-70			
DR'N. E.R. CK'D.			
AP'VD.			

TITLE FOCUS COIL CURRENT REGULATOR

NO. SM - 119



NOTE:
TRANSFORMER LEADS 1 THRU 6 ARE # 22 WHITE.

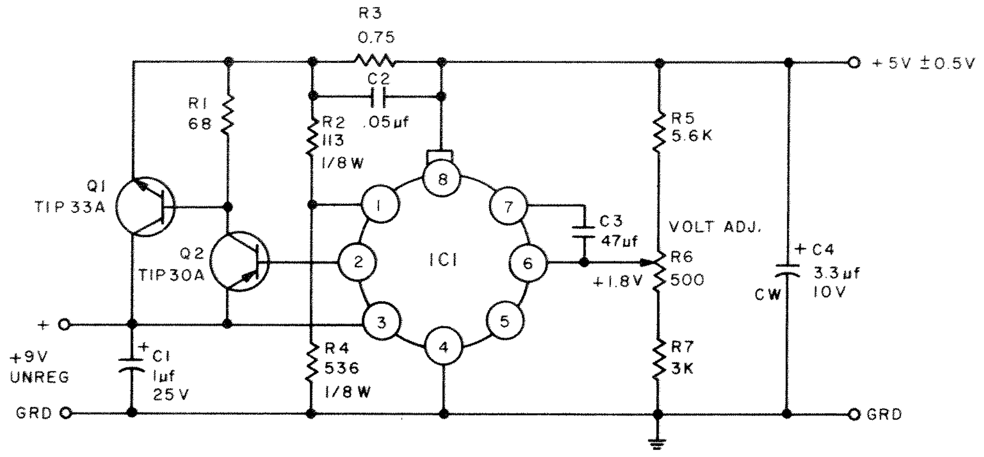
COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET.,
DENVER, COLORADO 80223.

SCALE		REVISION	BY	DATE
DATE				
DR'N.	CK'D.			
AP'VD.				

TITLE
MONITOR HIGH VOLTAGE POWER SUPPLY
AND REGULATOR

NO.



COMPUTER
IMAGE
CORPORATION

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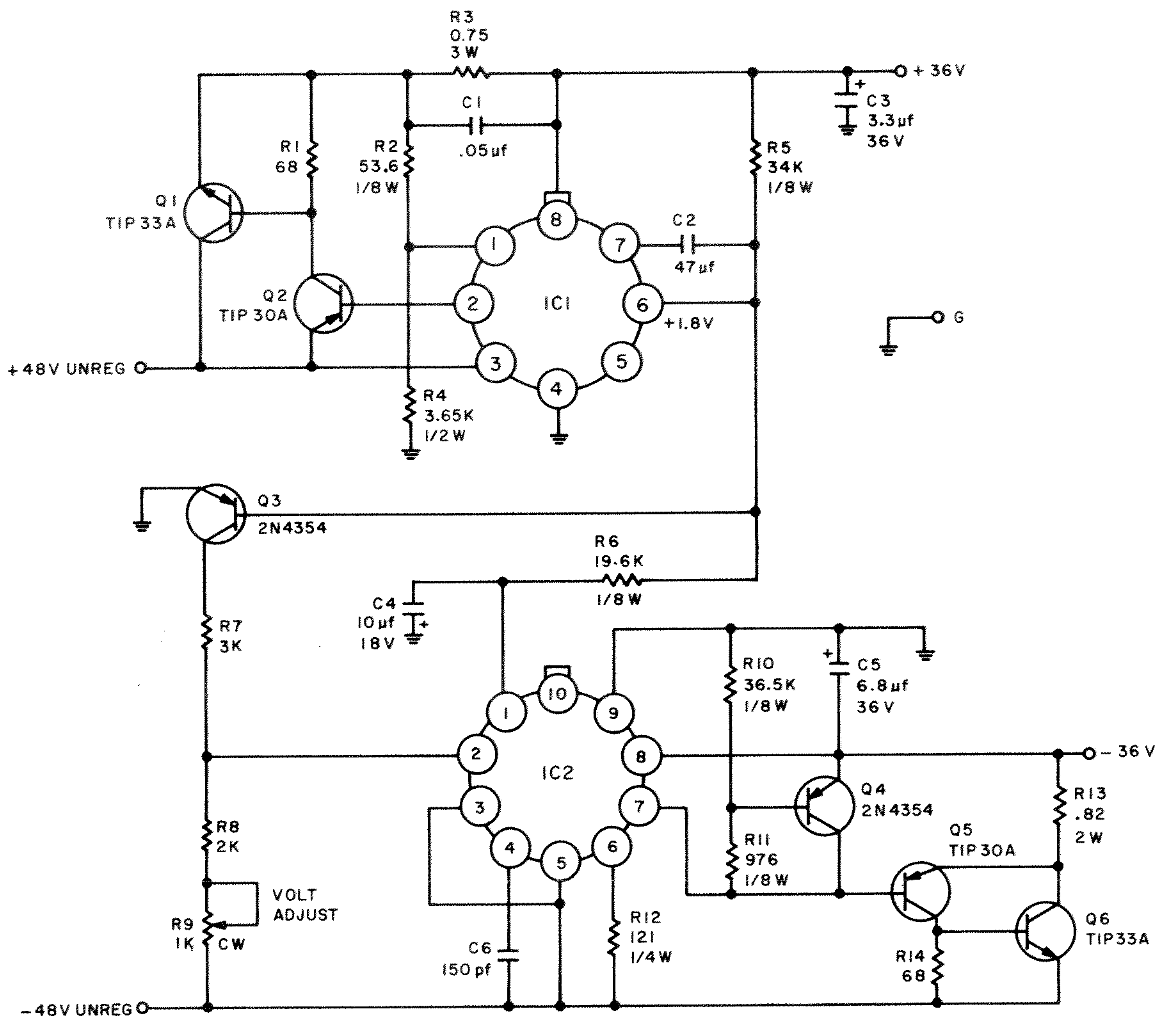
DENVER, COLORADO 80223.

SCALE		REVISION	BY	DATE
DATE				
DR'N	CK'D.			
AP'VD.				

TITLE
+5 VOLT REQULATOR

NO.



COMPUTER
IMAGE
CORPORATION

2162 SOUTH JASON STREET.,
DENVER, COLORADO 80223.

SCALE		REVISION	BY	DATE
DATE				
DR'M.	CK'D.			
AP'VD.				

TITLE
± 36 VOLT REGULATOR

NO.